A Lexical Approach to Presupposition and Meaning

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Deutsche Zusammenfassung

Schon über mehr als ein Jahrhundert lang gibt es die Untersuchungen zur Präsuppositionstheorie. Die Präsuppositionstheorie nahm ihren Anfang mit einer Besorgnis Freges bezüglich der Bedeutung definiter Kennzeichnungen. Frege war der Meinung dass mit diesen Ausdrücken Korrektheitsbedingungen verbunden sind: eine definite Kennzeichnung ist nur dann korrekt, wenn sie einen eindeutig bestimmten Referenten hat, und dazu muss ihr deskriptiver Inhalt von genau einem Objekt erfüllt sein. Ist diese Bedingung erfüllt, dann ist das eine diesen Inhalt erfüllende Objekt der Referent; ist sie nicht erfüllt, dann gibt es keinen Referenten, und die definite Kennzeichnung ist 'defekt'. Dieser Defekt vererbt sich auf jeden Satz, der die Kennzeichnung enthält. Auch er ist 'bedeutungslos': er hat keinen Wahrheitswert, ist weder wahr noch falsch. Frege sah solche 'bedeutungslose' Sätze als Bedrohung der Logik seiner Begriffsschrift, in der davon ausgegangen wird, dass jeder Satz einen Wahrheitswert hat. Daher sah er auch die Möglichkeit refererenzloser definiter Kennzeichnungen als ein potentiell gravierendes Problem.

Die Russellsche 'Theory of Desriptions' beseitigt Frege's Problem indem sie eine Methode liefert, mit der definite Kennzeichnungen eliminiert werden können. Dabei werden die Korrektheitsbedingungen der Kennzeichnungen in die logischen Formen der Sätze inkorporiert, die diese Kennzeichnungen als Konstituenten enthalten. Demnach ist ein einfacher Satz, in dem eine referenzlose Kennzeichnung vorkommt, falsch, also nicht ohne Wahrheitswert. Bei logisch komplexen Sätzen, wie etwa Negationen, kann sich die Inkorporierung der Korrektheitsbedingungen auch anders auswirken, etwa in dem sie dadurch zu wahren Sätzen werden.

Etwa ein halbes Jahrhundert später griff Strawson die Debatte wieder auf. Er argumentierte, dass die 'Theory of Descriptions' unserem Gebrauch von definiten Kennzeichnungen nicht gerecht wird. Viele Verwendungen von Sätzen mit referenzlosen Kennzeichnungen nehmen wir als 'bedeutungslos' wahr- sie haben weder einen Wahrheitswert noch einen wohl-definierten propositionalen Gehalt. (Da keine Proposition ausgedrückt wird, kann die äußerung auch keinen Wahrheitswert bestimmen, denn für Strawson sind die Propositionen die eigentlichen Träger von Wahrheitswerten.) Strawson machte in diesem Zusammenhang zwei weitere Unterscheidungen- zwischen Sätzen und äußerungen von Sätzen und zwischen Satzbedeutung und propositionalem Gehalt. Es sind die äußerungen von Sätzen, denen ein propositionaler Gehalt zugeschrieben werden kann, nicht den Sätzen an und für sich. Und wenn ein Satz eine Kennzeichnung enthält, die- im gegebenen äußerungskontext keinen Referenten hat, dann wird diese äußerung des Satzes keine Proposition bestimmen, und die Frage 'wahr oder falsch?' kann gar nicht erst aufkommen. Aber auch in den Fällen, wo die äußerung eines Satzes s nicht zum Ausdruck einer Proposition führt, folgt daraus nicht, dass s keine Bedeutung (oder, in Fregescher Terminologie, keinen 'Sinn') hat. Ein Beispiel ist Russell's 'The king of France is bald'. Wenn man diesen Satz im 20-ten Jahrhundert äußert, dann wird keine Proposition ausgedrückt und kein Wahrheitswert bestimmt. Aber das gilt nicht für äußerungen dieses selben Satzes vor der Mitte des 19-ten Jahrhunderts. Damals hatte die Kennzeichnung 'the king of France' immer einen Referenten und wurde demnach durch die äußerung eine Proposition bestimmt . Und damit zeigt sich, dass der Satz an sich einen Fregeschen Sinn besitzt; denn ohne den hätte man ihn nie zu einer inhaltlichen Aussage verwenden können.

Damit hat Strawson die Fregesche Intuition, dass die Verwendung definiter Kennzeichnungen durch Präsuppositionen (der eindeutigen Erfüllung ihrer deskriptiven Inhalte) bedingt ist, neu belebt. Wenn die Präsupposition einer Kennzeichnung, die Teil einer Satzäußerung ist, verletzt ist, dann drückt diese Satzäußerung keine Proposition aus und hat sie keinen Wahrheitswert; und ist die Verletzung der Präsupposition vom äußerungskontext unabhängig, so muss der Satz selbst als bedeutungslos eingestuft werden.

Nicht lange nach dieser Neubelebung der Fregeschen Auffassung des präsuppositonalen Charakters definitiver Kennzeichnungen wurde es den Linguisten bewusst, dass das gleiche Phänomen- wenn bestimmte Bedingungen nicht erfüllt sind (im Kontext, in dem ein Satz geäußert wird, dann lässt sich die äußerung nicht ohne weiteres als wahr oder falsch qualifizieren- sich nicht auf die Präsuppositionen eindeutiger Erfüllung definiter Kennzeichnungen beschränkt; es lässt sich auch in Bezug auf viele andere Ausdrücke beobachten. Neben den definiten Kennzeichnungen gibt es viele weitere 'Präsuppositionserzeuger', einzelne Lexeme sowohl als auch bestimmte grammatische Konstruktionen. Damit war die Präsupposiionstheorie etabliert, wie wir sie heute kennen. Und die Frage, ob definite Kennzeichnungen im Sinne von Frege-Strawson oder Russells 'Description Theory' zu analysieren sind, verliert an diesem Punkt viel von ihrer methodologischen Bedeutung: auch wenn man sich für die Russellsche Analyse entscheidet, ist damit Präsupposition als sprachliches Phänomen nicht beseitigt.

In Kapitel 1 wird zuerst die *semantische Betrachtung* von Präsuppositionen skizziert. Diese Sicht, die meistens auf Frege und Strawson zurückgeführt wird, definiewrt Präsupposition in Terminis von logische Implikation. Wenn eine Konstituente eines Satzes ϕ eine Präsupposition ψ erzeugt, dann kann in einem Kontext, in dem ψ falsch ist, die äußerung von ϕ weder wahr noch falsch sein. Oder vereinfacht, indem wir den Kontext fixieren: Wenn ψ falsch ist, dann kann ϕ weder wahr noch falsch sein. Durch Umkehrung ergibt sich daraus, dass ψ sowohl aus ϕ als auch nicht-ϕ folgt. In der klassischen Logik ist dies nur dann möglich, wenn ψ logisch wahr ist. Im allgemeinen sind aber Präsuppositionen keine logische Identitäten. Also zwingt uns diese Inferenzbasierte Präsuppositionscharakterisierung die klassische Logik durch eine andere 'präsuppositonsgerechte' Logik zu ersetzen. Den erheblichen Aufwand, mit dem man über Jahre hinweg eine solche alternative Logik zu entwickeln versucht hat, muss rückblickend wohl als Energieverschendung eingestuft werden.

Es gibt aber auch einen zweiten Aspekt der semantischen Sicht zur Präsuposition: Präsupposition werden von einzelnen Wörtern und Konstruktionen erzeugt, und dabei handelt es sich um eine linguistische Eigenschaft dieser Wörter und Konstruktionen, die sie als Elemente der Sprache an sich besitzen- also unabhängig von der Verwendung der Sprache durch ihre Sprecher. Im Gegensatz zu der Inferenz-basierten Definition des Präsuppositionsbegriffs hat sich diese Ansicht bis zum heutigen Tag erhalten und ist sie jetzt Bestandteil der meisten führenden Präsuppositionstheorien.

Empirisch ist die These, dass die Erzeugung bestimmter Präsuppositionen zu den linguistischen und damit festgeschriebenen Eigenschaften von bestimmten Lexemen und Konstruktionen gehört, in einer Menge von *Präsuppositionstests* begründet. Betrachten wir die Annahme, dass ein Satz ϕ wegen eines Präsuppositionserzeugenden Ausdrucks, den er enthält, eine Präsupposition ψ erzeugt. Dann wird die Anwendung der Präsuppositionstests auf ϕ diese Behauptung entweder erhärten oder widerlegen. Zum Beispiel- dies ist der sogenannte 'Negationstest'- sollen, falls die Annahme stimmt, sowohl die Behauptung von ϕ als auch die von nicht-ϕ implizieren, dass ψ der Fall ist. ähnliches gilt für den 'Fragetest', einen zweiten Präsuppositionstest: Wenn Dich einer fragt, ob ϕ der Fall sei, und Du weißt, dass ψ nicht der Fall ist, so kannst Du die Frage guten Gewissens weder einfach mit 'ja' oder einfach mit 'nein' beantworten; vielmehr obliegt Dir, den Fragenden auf das Nicht-Zutreffen von ψ hinzuweisen. Die gängigen Präsuppositionstests haben sich insgesamt als recht zuverlässig erwiesen. In Kapitel 1 wird eine Anzahl dieser Tests erwähnt und diskutiert.

Eine ganz andere Sicht auf das Präsuppositionsphänomen ist die sogenannte *pragmatische*. Nach dieser maßgeblich von Stalnaker vertretene Sichtweise (e.g. Stalnaker, (1974)) sind Präsuppositionen immer Annahmen, die von einem Sprecher gemacht werden, meistens zur Vereinfachung der Worte, die er zur Vermittlung neuer Informationen einsetzten muss. Was er dann sagt, führt dann zur Modifikation des Kontextes, den er vorausgesetzt hatte. (Hier zeigt sich zum ersten Mal die dynamische Dimension sprachlicher Kommunikation, worauf wir gleich ausführlicher zu sprechen kommen werden.)

In derzeitigen Präsuppositionstheorien ist der Gegensatz zwischen der pragmatischen und der semantischen Sichtweise, als sich gegenseitig ausschließende Perspektiven, weitgehend aufgehoben: bestimmte Wörter und Konstruktionen sind Präsuppositionserzeuger- das ist Teil der unabhängig vom Gebrauch festgelegten Eigenschaften der Sprache als eigenständiges Symbolsystem. Aber da Sprecher ihre Sprache können, wissen sie um die Präsuppositionen ihrer Wörter und Konstruktionen bescheid, und werden diese deshalb nur dann verwenden, wenn sie meinen, es ist vertretbar, die Präsuppositionen vorauszusetzen- etwa, weil diese ohnehin schon Bestandteil des Kontexts sind, den sie mit ihren Adressaten teilen.

Seit den späten sechziger Jahren war für die linguistische Präsuppositionsforschung das *Projektionsproblem* maßgeblich. Manchmal verschwinden Präsuppositionen, die in einfachen Sätzen vorhanden sind, wenn diese als Teile logisch komplexer Sätze auftreten. (Sowohl das Vorhandensein der Präsupposition in den einfachen Sätzen als auch ihr Verschwinden in den komplexeren werden nicht nur von Sprechern so empfunden, sondern auch durch die Präsuppositionstests bestätigt.) In solchen Fällen wird die Präsupposition nicht 'projiziert', wie es offiziell heißt, zwischen der Stelle, wo sie erzeugt werden, bis zur oberen Ebene des gesamten Satzes bleiben sie irgendwo auf der Strecke. Inzwischen sind viele Aspekte des Projektionsproblems weitgehend geklärt. Dieser Fortschritt ist weitgehend der Dynamischen Semantik zu verdanken, die aus den Arbeiten von Vorläufern wie Stalnaker und Karttunen (Karttunen, 1974) hervorgegangen ist, und sich in den formal expliziten Theorien wie etwa die File Change Semantics (Heim, 1983b) und Diskursrepräsentationstheorie (Kamp, 1981) auskristallisiert hat. Entscheidende Beiträge in diesem Rahmen zum Projektionsproblem sind (Heim, 1983) und Van Der Sandt (1992).

Die allgemeine Lösung, die dynamische Präsuppositionstheorien für das Projektionsproblem bereitstellen, beruht auf dem Begriff eines 'lokalen Kontextes', der in der Dynamischen Semantik eine zentrale Rolle spielt. Nach der Dynamischen Semantik fungieren bestimmte Teile logisch komplexer Sätze als Kontexte für die Interpretation anderer Teile. Wenn ein solcher lokaler Kontext eine Präsupposition impliziert (oder aufzulösen erlaubt), die innerhalb von einem anderen Teil des Satzes, für den er als Kontext verfügbar ist, erzeugt wurde, dann ist damit diese Präsupposition auf lokaler Ebene 'abgehakt' und wird sie entsprechend nicht projiziert. Dies ist der weitaus häufigste Grund weshalb Präsuppositionen nicht projiziert werden.

Weil die in dieser Dissertation verwendeten Ansätze zur Lösung von Präsuppositionsfragen alle auf dem dynamischen Ansatz basieren, werden im ersten Kapitel beide schon erwähnten Dynamischen Theorien (File Change Semantics und

Diskursrepräsentationstheorie) eingeführt. Genauer gesprochen bauen die Vorschläge, die in der Arbeit entwickelt werden, auf der DRT auf. In dieser Theorie werden Präsuppositionen ähnlich wie anaphorische Ausdrücke analysiert und mit ähnlichen Mechanismen resolviert und zwar indem in einem der zugänglichen lokalen Kontexten bzw. im globalen Kontext ein 'Antezedenz'für Aanpher oder Präsupposition gesucht wird. Es gibt zwei Aspekte dieses DRT-basierten Ansatzes, die anderen dynamischen Theorien- wie etwa die von Stalnaker, Karttunen oder Heim- fehlt: (i) Die in einem Satz erzeugten Präsuppositionen werden als Teil einer vorläufigen semantischen Satzrepräsentation ('Preliminary DRS', es handelt sich hier um einen technischen. Formal definierten Begriff) berechnet und dargestellt. (ii) Die Stelle, an der sich die Repräsentation einer Präsupposition befindet, bestimmt welche lokalen Kontexte- diese sind ebenfalls als Teilrepräsentationen der vorläufigen Repräsentation identifizierbar- für die Resolution der Präsupposition in Betracht kommen. Diese lokalen Kontexte befinden sich alle auf dem sogenannten Projektionspfad', der an der Stelle der Präsuppositionsrepresentation beginnt. Dieser Pfad lässt sich mit Hilfe der strukturellen Eigenschaften von DRSen definieren und spielte von Anfang an eine zentrale Rolle (vergl. den 'accessibility' Begriff in Kamp (1981).

Van Der Sandt (1992) verwendete Projektionspfade in seiner Definition eines expliziten Auflösungsverfahrens für Anaphern und Präsuppositionen. Dieser Algorithmus erscheint als der problematischere Teil seiner Präsuppositionstheorie. Und zwar gibt es zwei Arten von Einwänden gegen ihn. Einerseits macht er in bestimmten Fällen falsche Vorhersagen. Andererseits wird über Fälle, in denen es mehrere mögliche Auflösungen einer Anapher oder Präsupposition geht, überhaupt keine Aussage gemacht. (Unter diesem Gesichtspunkt stellt sich die Theorie auf den selben Standpunkt wie die klassische DRT überhaupt, in der es nur darum gehen soll, zu explizieren, welche Auflösungsmöglichkeiten aus der logisch-strukturellen Sicht der Theorie es für ein anaphorisches Element gibt, und nicht darum, wie bei mehreren Auflösungsmöglichkeiten eine Auswahl getroffen werden kann oder muss.)

Kapitel 2 enthält einen umfassenden Überblick der derzeitigen Fragen, die sich aus dem DRT-basierten Ansatz zur Präsuppositionstheorie ergeben. Die meisten dieser Fragen lassen sich in zwei Klassen einteilen. Erstens beschränken sich Theorien wie die Van Der Sandts auf die rein sprachlich vermittelten Informationen, die Diskurs oder Text verfügbar machen. Andere Informationen können nicht ins Spiel gebracht werden. Dies wird insbesondere dann zum Problem, wenn eine Anapher oder Präsupposition akkommodiert werden muss. Was für Informationen sind zu akkommodieren? Wo kommen diese Informationen her? Insbesondere für Präsuppositionen ist dieses Frage alles andere als trivial, und zwar deshalb, weil in der Praxis sprachlicher Kommunikation oft nicht die Präsupposition selbst akkommodiert wird, sondern Informationen, die sie implizieren. Andererseits sind bei der Auswahl aus mehreren Antezendenten für eine Anapher oft auch Informationen benötigt, die dem Empfänger der äußerung zwar verfügbar aber weder in der äußerung selbst noch im Diskurkontext vorhanden sind.

Die zweite Klasse von Problemen bezieht sich auf die Auflösung von Anaphern und zwar auf technische Aspekte der vandersandtschen Theorie und ihrer Implementierung. Hier geht es um Verfeinerungen von Van Der Sandts Auflösungsverfahrens, und dazu braucht man wiederum eine Erweiterung des Konzeptrepertoires. Dies betrifft insbesondere die genaue Beschreibung von präsuppositionstilgenden Mechanismen wie *Presupposition Cancelation* (Horn, 1985; 1989) und *Filtering* (Karttunen, 1973).

Zusätzlich gibt es auch einige wichtige Aspekte der Präsuppositionstheorie, die bisher in der Literatur noch kaum beachtet worden sind, für deren Analyse ein DRT-basierter Ansatz aber besonders geeignet zu sein scheint. Einer von diesen sind die *Interaktionen* zweier oder mehrerer Präsuppositionen. Die meisten Päsuppositionsstudien beschränken sich auf die Betrachtung einzelner Präsuppositionen- wie sehen sie aus wie werden sie gebunden, wie können sie akkommodiert werden? Dass ein Satz mehr als einen Präsuppositionserzeuger enthält, ist aber eher die Regel als die Ausnahme und die Interaktionen zwischen den von diesen Triggern erzeugten Präsuppositionen sind ein Problem für sich.

Kapitel 2 enthält einige Beispiele dieses komplizierenden Faktors, insbesondere eins, in dem die Präsupposition einer Possessivphrase- Possessivphrasen verhalten sich ähnlich wie definite Kennzeichnungen und erzeugen ähnliche Präsuppositionen- und dem Präsuppositionserzeuger *again*. Wegen unterschiedlicher Skopusmöglichkeiten gibt es in dem diskutierten Beispiel vier verschiedene, durch die Interaktion die beiden Präsuppositionen bedingte Lesarten. Für die korrekte Analyse solcher Mehrdeutigkeiten ist ein detaillierter Algorithmus für die Berechnung von Präsuppositionsrepräsentationen unverzichtbar. Deshalb eignet sich der DRT-basierte Ansatz für diese Art von Fragen.

Das den Kapiteln 1 und 2 der Dissertation gemeinsame Ziel ist es, einen Abriss der Präsuppositionstheorie von den Anfängen in dem Denken Freges und Russells bis zu derzeitigen Theorien und Fragestellungen bereit zu stellen, wobei insbesondere die neueren Fragestellungen berücksichtigt sind, die aus den dynamischen Ansätzen zur Präsuppositionstheorie und namentlich aus DRT-basierten Theorien hervorgegangen sind.

Die meisten Präsuppositionserzeuger sind einzelne Wörter. In solchen Fällen ist vieles, das mit den von dem Wort erzeugten Präsuppositionen zu tun hat, Teil von dem semantisch-pragmatischen Verhalten dieses Wortes und muss deshalb als Teil seines Lexikoneintrags kodiert werden. Damit ergeben sich neue und in vielen Fällen sehr komplexe Aufgaben für das Lexikon, sowohl was die Frage betrifft, was für Informationen alles kodiert werden müssen, als auch wie sie zu kodieren sind. In dieser Arbeit wird diesen Fragen hauptsächlich in Bezug auf einen lexikalischen Präsuppositionserzeuger nachgegangen, und zwar bzgl. des englischen definiten Artikels *the*. *The* dient dazu, aus NP-Konstituenten vollwertige DPen ('Determiner Phrases') zu bilden, unter anderem die definiten Kennzeichnungen im Singular, die schon gleich am Anfang der Dissertation als Ausgangspunkt für die gesamte Diskussion dienen.

Kapitel 3, das ausschließlich definiten Kennzeichnungen (sowohl im Plural als auch im Singular) gewidmet ist, lässt sich als das Unterfangen verstehen, einen wichtigen

Teil dessen auf den Punkt zu bringen, was in den lexikalischen Eintrag für *the* letztendlich eingehen sollte. Die erste Aufgabe des Kapitels ist, die formalen Grundlagen zu erstellen, die die notwendige Voraussetzung für eine solche Untersuchung bilden. Zum Teil müssen die Informationen, die in einem Lexikoneintrag kodiert sind, direkt in die Repräsentationen eingebracht werden können, die die Theorie für Sätze zu konstruieren vorgibt, in denen das betreffende Lexem als Konstituente vorkommt. Deshalb muss man sich, bevor man sich der Frage nach der Form der im Eintrag kodierten Informationen widmet, zuerst auf ein Konstruktionsverfahren für Satzrepräsentationen festlegen. In der Arbeit wird das "Box + λ"-Verfahren von Blackburn und Bos verwendet. Die Eingaben für dieses Verfahren sind syntaktische Bäume, die von einer GPSG Grammatik erzeugt werden. Das Verfahren besteht darin, dass jeder Knoten des Eingabebaums mit einer λ-DRS annotiert wird, und zwar, in dem das Verfahren 'bottmom-up' verfährt: die Annotation eines Mutterknotens ergibt sich immer aus den Annotationen ihrer Töchter. (Die Annotation des Satzknotens ergibt dann die (vorläufige) Satzrepräsentation.) Indem es sich hoch arbeitet, berechnet das Verfahren auch die von den jeweiligen Präsupposisitonserzeugern im Baum erzeugten Präsuppositionen. Sowohl für die nicht-präsuppositionalen Teile der Satzrepräsentation als auch für die lexikalisch erzeugten Präsuppositionen ist die Form der relevanten Informationen im Lexikon entscheidend.

Nachdem man sich für eine allgemeine Syntax-Semantik-Schnittstelle entschieden hat, ist es möglich, einen auf diese Schnittstelle zugeschnittenen Eintrag für *the* zu definieren. Wie schon angedeutet, ist diese Aufgabe eine doppelte. Erstens muss eine geeignete Form für die Präsuppositionen gefunden werden, die von definiten Kennzeichnungen erzeugt werden und ebenfalls für den Beitrag, den diese zum nicht-präsuppositonalen Teil der Satzrepräsentation leisten. Zweitens muss der Eintrag auch in geeigneter Weise die Prinzipien vermitteln, nach denen die von *the* ausgelösten Präsuppositionen resolviert werden, nachdem die präliminäre Repräsentation fertig gestellt worden ist. Was die erste Aufgabe betrifft, hier zwei Beobachtungen. (i) Ich habe mich hier für eine Kodierung der Präsuppositionen definiter Kennzeichnungen entschlossen, die auf Link(1983) zurück geht. Link plädiert für eine einheitliche Behandlung von Kennzeichnungen im Singular und im Plural- also für eine Semantik, die sowohl für singulares als auch plurales *the* gilt. Pluralen und singularen definiten Kennzeichnungen ist gemeinsam, dass der Referent immer die Totalität aller Erfüller des deskriptiven Gehalts der Kennzeichung ist. Präsupponiert ist dabei nur, dass es einen oder mehrere Erfüller gibt. Wird diese Information mit dem Merkmal 'singular' kombiniert, so trägt dieses die Präsupposition bei, nach der der Referent 'atomar'- also ein einziges Individuum- ist. Auf diese Weise kommt die 'Eindeutigkeitspräsupposition' singularer Kennzeichnugen zustande. Das Merkmal 'plural' trägt die Präsupposition bei, dass es sich beim Referenten um eine nicht atomare Entität, also um zwei oder mehr Erfüller handelt. (ii) Es ist offensichtlich und seit jeher bekannt, dass die Eindeutigkeitsbedingung für die meisten singularen definiten Kennzeichnungen nur dann erfüllt ist, wenn man annimmt, dass der deskriptive Gehalt der Kennzeichnung durch ein zusätzliches, implizites und aus dem Kontext zu ermittelnden Prädikats C verstärkt wird. Bei Kennzeichnungen im Plural sind implizite, Kontext-abhängige Prädikate ebenfalls wichtig. C bringt eine zusätzliche Anforderung an den Kontext- also eine zusätzliche Präsupposition- ins Spiel. In dem Eintrag für *the*, der in Kapitel 3 vorgeschlagen wird, sind (i) und (ii) beide berücksichtigt.

Die zweite Aufgabe, die es im Rahmen des Eintrags für *the* zu erledigen gibt, betrifft die Prinzipien, nach denen Präsuppositionen von definiten Kennzeichnungen aufgelöst werden. Nach Van Der Sandt werden Präsuppositionen entweder 'gebunden' oder 'akkommodiert'. Dieses Prinzip ist insofern irreführend, als die Resolution einer Präsupposition oft auf einer Kombination von Bindung und Akkommodierung beruht. Dies trifft insbesondere auf die Präsuppositionen von definiten Kennzeichnungen zu. Bindung der Präsupposition einer definiten Kennzeichnung im Sinne von Van Der Sandt erfolgt typischerweise dadurch, dass der Diskursreferent x, der den Referenten der Kennzeichnung vertritt, mit einem schon im Diskurskontext (oder in einem lokalen Kontext der vorläufigen DRS, zu der auch die Präsupposition selbst gehört) vorhandenen Diskursreferenten y identifiziert wird. Dazu ist aber manchmal notwendig, dass zuerst eine oder mehrere Eigenschaften, die die Kennzeichnung ihrem Referenten zuschreibt, für den als bindendes Antezedens intendierten Diskursreferenten y akkommodiert werden. Die Notwendigkeit einer solchen Akkommodierung ergibt sich aus einem Vergleich des deskriptiven Inhalts der Kennzeichnung mit dem der Nominalphrase, die für die Einführung von y verantwortlich war.

Vergleiche dieser Art sind für eine präzise Beschreibung der Auflösungsprinzipien entscheidend. Die Beziehungen zwischen Kennzeichnung und ihren potentiellen Antezedenten können nach unterschiedlichen Kriterien klassifiziert werden. Im Kapitel 3 werden zwei Kriterien verwendet, ein *Implikations-basiertes* und ein *Form-basiertes* Kriterium. Die Klassifikationen der Relationen nach diesen Kriterien sind insbesondere dann wichtig, wenn zwischen mehreren potentiellen Antezedenten gewählt werden muss. Kapitel 3 enthält eine recht ausführliche Diskussion der Faktoren, die bei dieser Auswahl eine Rolle spielen. Dabei werden insbesondere die Implikations-basierten und die Form-basierten Relationen berücksichtigt. Von besonderem Interesse ist die Interaktion zwischen diesen beiden Typen von Relationen. Wie sich zeigt, haben die Implikations-basierten Relationen eine vorrangige Stellung; Form-basierte Relationen werden nur dann entscheidend, wenn die Implikations-basierten keine Entscheidung herbeiführen.

Die Untersuchungen von Kapitel 3 haben noch nicht zu einem endgültigen Ergebnis geführt. Aber sie verschaffen uns immerhin ein vorläufiges Bild von den unterschiedlichen Faktoren, die bei der Auflösung von Kennzeichnungspräsuppositionen eien Rolle spielen können. In den meisten Präsuppositionsstudien werden diese Faktoren schlicht ignoriert.

Eine weitere Fallstudie ist Gegenstand von Kapitel 4. Hier geht es ebenfalls um definite Kennzeichnungen, aber um Kennzeichnungen besonderer Art. Genauer: es geht um drei Ausdruckstypen, jeweils erkennbar an der From ihres deskriptiven Teils (ihrer NP-Konstituente in der Terminologie der Generativen Syntax): (i) die NP besteht aus einem Kopfnomen N, dem eine 'Ordinalzahl als pränominales Adjectiv vorangeht (etwa 'first', 'second', 'third', ...); (ii) die NP besteht aus N vorangegangen von einem Superlativ ('highest', 'latest', 'darkest', ...); (iii) die NP besteht aus enem N, dem eine Ordinalzahl und ein Superlativ vorangehen ('third highest', 'second biggest', ...). Die definiten Kennzeichnungen von Typ (ii) und (iii) gibt es sowohl im Singular als auch im Plural. (Plurale vom Typ (i) gibt es ebenfalls. Aber sie scheinen anderen Gesetzen zu gehorchen als die so eben erwähnten. In Kapitel 4 sind sie nicht berücksichtigt)

Aus der Perspektive der Präsuppositionstheorie sind diese Kennzeichnungen von Interesse, weil sie abgesehen von dem Präsuppositionstrigger *the*, den sie mit anderen definiten Kennzeichnungen gemeinsam haben, zusätzlich noch einen oder zwei weitere Präsuppositionsträger enthalten. Das Adjektiv n_{th} präsupponiert, wenn es dem Kopfnomen N vorangeht, eine geordnete Menge $<X, \prec>$, in der X eine Menge von Elementen aus der Extension von N mit Kardinalität größer oder gleich n ist. Überdies muss X die Schnittmenge der Extension von N und der Extension des von n_{th} präsupponierten Prädikats C sein. Die Rekonstruktion von X muss also mit der von C abgestimmt sein, und dazu muss eine Ordnungsbeziehung $\prec$ über die Menge aus dem Kontext rekonstruiert werden. Der nicht-präsuppositionale Teil der Semantik von n_{th}besteht dann darin, dass das n-te Element von X im Sinne von $\prec$ zum alleinigen Element der Extension von n_{th} bestimmt wird. Damit ist sichergestellt, dass der deskriptive Inhalt genau einen Erfüller hat und somit ist dieses Element auch der Referent der Kennzeichnung *the* n_{th} *N*.

Die Semantik von Superlativen hat mit der Semantik der Ordinalzahlte vieles gemeinsam, aber wie wir gleich sehen werden, gibt es auch Unterschiede. Ein Superlativ, der dem Nomen N vorangeht, präsupponiert ebenfalls eine Menge X von Elementen aus der Extension von N, und auch hier ist diese Menge die Schnittmenge der Extension von N mit der von C. Und auch hier handelt es sich um eine geordnete Menge. Nur gibt es hier keinen Bedarf, die Ordnung aus dem Kontext zu rekonstruieren, da sie vom deskriptiven Inhalt selbst bestimmte wird, und zwar von dem in ihm enthaltenen Adjektiv. Adjektive, die den Superlativ zulassen, sind im allgemeinen 'gradierte' Adjektive, die jedem Objekt in ihrer Extension einen Grad zuordnen. Die Ordnung der Grade induziert dann eine Ordnung (genauer: eine Pre-Ordnung) auf die Menge der Objekte. Das N vorangehende Prädikat (das Adjektiv in seiner superlativen Form) selegiert als aus der Menge X eine Teilmenge Y, dahingehend, dass jedes Element in Y größer (im Sinne des Adjektivs) als jedes Element der Restmenge X Y ist. Damit ist Y die Menge der Erfüller des deskriptiven Inhalts der Kennzeichnung. Haben wir es mit einer definiten Kennzeichnung im Singular zu tun- etwa mit *the highest N*-, dann trägt das Merkmal 'singular' die Präsupposition bei, nach der diese Extension aus einem einzigen Element besteht. Also gibt es in X ein einziges Element das höher als alle andere Elemente von X ist und ist Y die aus diesem Element bestehende Einermenge. Zugleich ist dieses Element dann auch der Referent der Kennzeichnung, ganz im Einklang mit unseren Intuitionen über die Bedeutung von *the highest N*. Ist die Kennzeichnung ein Plural- etwa *the highest Ns*-, dann trägt das Merkmal 'plural' de Präsupposition bei, dass es sich bei Y um eine Menge handelt, die aus mehreren Elementen besteht. Damit besteht der Referent von *the highest Ns* aus mehreren Elementen, aber jedes von diesen ist höher als alle Elemente in der Restmenge X Y. Auch dies entspricht unseren Intuitionen.

Bei Kennzeichnungen vom dritten Typ, wie *the* n_{th} *highest N* haben wir es abgesehen von *the* mit zwei Präsuppositionserzeugern zu tun, n_{th} und *highest*. Intuitiv gesprochen ist die Semantik solcher Kennzeichnungen etwa wie folgt. Es gibt mehrere Elemente, die sich als 'highest N' beschreiben lassen, und diese können angeordnet werden: es gibt ein '(first) [highest N]', ein 'second [highest N]' und so weiter. '(first) [highest N]' beschreibt die Riege der höchsten Elemente von X, 'second [highest N]' die Riege der zweithöchsten, und so fort. Wenn Ordinalzahl und Superlativauf diese Weise miteinander verknüpft sind, stehen auch die von ihnen präsupponierten Mengen in einer sehr engen Beziehung. Das ergibt sich schon aus dem oben schon zwei mal angewandten Prinzip, dass beide Mengen mit der Schnittmenge von der Extension von N und der von C identisch sein müssen, denn daraus folgt, dass sie auch miteinander identisch sind. (Es ist unklar, ob sich die Semantik der Kombination 'Ordinalzahl + Superlativ' ohne besondere Annahmen beschrieben werden kann, die ausschließlich auf eben diese Kombinationen zutreffen.)

Bei Kennzeichnungen des dritten Typs im Plural lässt sich folgendes beobachten.

Betrachten wir ein konkretes Beispiel. Es gibt fünf Berge, nach Höhe angeordnet als $<m_1, m_2, m_3, m_4, m_5>$. Nehmen wir an, dass von dieser Menge die Rede ist und dass der Sprecher, das Gespräch mit den Worten "I climbed the second highest mountains" eröffnet. Es steht ihm zu, sich so zu äußern und sich dabei mit "the second highest mountains" auf die Menge set $\{m_3, m_4\}$ zu beziehen- sozusagen, indem er diese Menge als die zweite Riege auszeichnet. Er kann dann fortfahren, indem er im nächsten Satz die Kennzeichnung 'the highest mountains' verwendet und damit auf die Menge $\{m_1, m_2\}$ zu verweisen, oder auch indem er mit 'the third highest mountain' auf m_5 verweist. Was ihm nicht zusteht, ist im Anschluss an seiner ersten Behauptung Satz 'the highest mountains ' zu verwenden und sich damit auf die Menge $\{m_1, m_2, m_3\}$ zu beziehen. Offenbar gilt die einmal gewählte Ordnung von X als im Kontext fixiert. Man kann sie nicht einfach im laufenden Gespräch ändern (zumindest nicht ohne seinem Gesprächspartner klar zu machen, das man dies tue).

Dies sind nur einige der bemerkenswerten Phänomene, die sich in Bezug auf Kennzeichnungen von den Typen (i), (ii) and (iii) beobachten lassen. Aber sie reichen, einen Eindruck davon zu vermitteln, was für Interaktionen zwischen Präsuppositionen unterschiedlicher Präsuppositionserzeuger möglich sind. Eine solche Interaktion ist die 'geteilte Auflösung' von zwei oder mehr Präsuppositionen, bei der eine kontextuelle Resource zur Rechtfertigung gleich mehrerer Anforderungen an den Kontext herangezogen wird.

Die Fallstudie von Kapitel 4 unterscheidet sich von der Untersuchung in Kapitel 3 darin, dass sie sich nicht nur auf Resolution von definite Kennzeichnugen im Diskurskontext beschränkt. Im vierten Kapitel wird die Frage thematisiert, wie Kennzeichnungen durch Bezug auf Informationen interpretiert werden können, die nicht Teil des Diskurskontexts sind. Eine systematische Untersuchung dieser Frage setzt einen Kontextbegriff voraus, nach dem Kontexte Informationen aus einer Vielfalt unterschiedlicher Quellen enthalten können. In Kapitel 4 werden dazu von den 'Articulated Contexts' Gebrauch gemacht, die in (Kamp, 2006) entwickelt werden. Artikulierte Kontexte bestehen aus einer Anzahl mit einander interagierenden

Komponenten, die entweder die Form einer DRS haben oder as DRS-ähnlichen Strukturen bestehen. Eine Komponente ist der aus allen Versionen der DRT bekannte Diskurskontext; dieser hat die Form einer DRS. Andere Komponenten, wie etwa die 'enzyklopädische Komponente, die als Speicher von Entitäten fungiert, die aufgrund geteilten oder allgemeinen Wissens den Gesprächspartnern geläufig sind, oder die 'Umgebungskomponente', in der die direkt zugänglichen Entitäten aus der unmittelbaren Umgebung abgelegt sind, enthalten Entitätsrepräsentationen, die ebenfalls als DRS-artige Strukturen definiert sind.

Artikulierte Kontexte stellen die Mittel zu einer systematischen Untersuchung der Optionen bereit, die es für die Resolution unterschiedlicher Typen von definiten Nominalphrasen gibt (außer definiten Kennzeichnungen Pronomina, Eigennamen, Demonstrativa). Die verschiedenen Typen unterscheiden sich unter anderem darin voneinander, dass sie auf unterschiedliche Komponenten des artikulierten Kontexts Zugriff erlauben. Definite Kennzeichnungen befinden sich unter diesem Gesichtspunkt an einem Ende eines Spektrums; sie erlauben Zugriff auf alle Komponenten. Damit sind sie zugleich auf eine besondere Art mehrdeutig: bei der Interpretation einer Kennzeichnung muss erst einmal geklärt werden, in welcher Komponente des artikulierten Kontexts sich die relevant Information befindet. Insgesamt zeigt sich hier eine neue Dimension zu der Frage, nach welchen Prinzipien die Resolution von Präsuppositionen erfolgen kann: auch die Quelle der dazu herangezogenen Information kann variieren.

Die Fallstudien in dieser Dissertationbeschäftigen sich alle mit definiten Kennzeichnungen. Das scheint auf den ersten Blick ein kleiner Bereich innerhalb eines sehr großen Gebietes zu sein, wenn wir uns vergegenwärtigen, wie viele Präsuppositionen und präsuppositionsauslösende Begriffe gegenwärtig bekannt sind. Nichtsdestotrotz haben die behandelten Fälle eine recht große Zahl unterschiedlicher Fragestellungen aufgeworfen, von denen einige wiederum bisher noch nicht die Aufmerksamkeit von Präsuppositionstheoretikern auf sich gezogen haben. Wie repräsentativ die analysierten Phänomene für das Gebiet in seiner Gesamtheit sind, darüber kann an dieser Stelle lediglich spekuliert werden. Man würde hoffen, dass sich dieselben The-men und Muster zeigen, wenn andere Präsuppositionen mit dem gleichen Grad an Aufmerksamkeit bedacht werden, aber dies muss vorerst ein offenes Thema bleiben.

Ein zentrales Anliegen bei den Untersuchungen der Prinzipien der Präsuppositionsprojektion in den Kapiteln 3 und 4 ist das Zusammenspiel von Präsupposition und Kontext. Vieles von dem, was ich mit meinen Untersuchungen ans Tageslicht zu bringen versucht habe, hat mit genau diesem Zusammenspiel zu tun. Ich habe diese eingehenden Untersuchungen durchgeführt, weil ich der Überzeugung bin, dass die Interaktion zwischen Kontexten und lexikalisch generierten Präsuppositionen ein wichtiger Teil der Semantik der entsprechenden präsuppositionsauslösenden Wörter ist. Notwendigerweise ist dies ein Bedeutunggsaspekt, der sich auf die Klasse der Präsuppositionstrigger beschränkt. Aber angesichts der Tatsache, dass so viele Präsuppositionsauslöser Wörter (und keine Konstruktionen) sind, und dass wiederum soviel Wörter Präsuppositionen auslösen, ist der angesprochene Aspekt, wenngleich nicht universell, so doch von so erheblicher Signifikanz für die lexikalische Bedeutung in vielerlei Hinsicht.

Chapter 1

A Concise History of Presupposition

1.1 How it all Started

The earliest discussion of the phenomenon of presuppositions in relation to a formal language probably traces back to the nineteenth century philosopher Gottlob Frege[1]. Frege's most significant contribution to modern logic was his ground breaking development of axiomatic predicate logic. Predicate logic uses quantified variables, which makes it far more expressive than Aristotelian syllogistic and Stoic propositional logic. Predicate logic could be used to represent inferences involving arbitrarily complex mathematical statements, and successfully deals with problems which traditional logic is unable to solve, such as the problem of multiple generality[2]. Amongst his many contributions, Frege is often credited with the principle of the compositionality of meaning, which is the principle that the meaning of a complex expression is determined by the meanings of its constituent expressions and its structure. This

[1]Frege, in his article "On Sense and Reference" (1892), in a footnote to a discussion about adverbial clauses, talks about the referential presupposition in the sentence: "after the separation of Schleswig-Holstein from Denmark, Prussia and Austria quarreled". Frege points out that the presupposition (*Voraussetzung*) in which Schleswig-Holstein must be thought of as part of Denmark, is a necessary condition for "the separation" to have a reference.

[2]The problem of multiple generality is the inability of traditional logic to determine valid inferences of statements involving more than one quantifier ("Problem of multiple generality", 2010). For example:

(i) Every number has a successor.

(ii) There is a successor preceded by every number.

The syntax of traditional logic permits only four sentence types: "All A's are B's", "No A's are B's", "Some A's are B's" and "Some A's are not B's". Each type is a quantified sentence that contains exactly one quantifier. However, (i) and (ii) each involve two quantifiers. The only way for traditional logic to deal with this is to reduce the second quantified expression to a term:

(i)′ Every number is (a-number-which-has-a-successor).

(ii)′ Some successor is (a-successor-preceded-by-every-number).

But even after this treatment, we cannot determine whether (i) entails (ii).

principle remains predominant in the field of mathematics, semantics, and natural language processing, playing a key role when logical representations are constructed from the syntactic structures of a given expression or formula. The details are spelled out formally subsequently, by people such as Tarski (1933; 1944), Montague (1970), Westerståhl (1998), and Janssen (1997; 2001).

Presuppositions were not Frege's central concern. However, according to him, an ideal language should have a truth value for every one of its well-formed sentences. Presuppositions then, make natural language an unfortunate exception to this ideal, because presuppositions must be met in order for the expression containing them to have a truth value. But sometimes presuppositions fail. For example, definite NPs come with a presupposition that they denote properly. Consider the following century old example (Russell, 1905):

(1) The King of France is bald.

The presuppositions in (1) are triggered by the definite NP 'the King of France'. Frege observed that a singular definite description like this has two constraints associated to its referential function: *There is at least one King of France*- a presupposition that 'the King' must denote an entity in the Model of interpretation; and *there is at most one King of France*- a presupposition that 'the King' is unique in the context. Neither of these are *asserted*, in other words they are not stated explicitly in (1), and for this reason they are called 'presuppositions'. These two presuppositions must be satisfied in order that the description can refer. If there is no King, or if there is more than one King of France, (1) will fail to have a proper truth value. Frege saw this as a shortcoming of natural languages when definite descriptions fail to denote some unique entity. The way in which he gets around this deficiency is to include a special *nil entity*, and whenever a definite description fails to satisfy the aforementioned presuppositions, to assign it to the nil entity. To put this formally, we first designate the *iota operator*, ℩ (an upside down Greek iota), for *descriptions* (Gamut, 1991). Descriptions are an addition to Frege's predicate logic vocabulary. They are complex terms like the universal quantifier $\forall$ and the existential quantifier $\exists$ in that they always come with a variable and are followed by a propositional function which is their scope. Let ϕ be a formula and x a variable, in order to interpret descriptions we add the following to the semantics of predicate logic:

(2) $[\![\iota x\phi]\!]_{\mathbf{M},g}$ is the unique individual d $\in$ D s.t. $V_{\mathbf{M},g[x/d]}(\phi) = 1$
If there is no such unique individual d $\in$ D, then x is assigned to d_0, where d_0 is the nil entity.

At this point we simply have to ensure that d_0 does not belong to the set of entities satisfying ϕ. In the example of (1), if there is no King of France, as long as d_0 does not belong to the interpretation of *bald*, (1) will be false because $d_0 \notin$ *bald*. This solution however, is *ad hoc* and merely scratches the surface of the problem of presupposition failure. Consider the negation of (1):

(1)′ The King of France is *not* bald.

Applying (2) to (1)′ just as we did for (1), when there is no King of France, the variable representing the King of France is assigned to d_0. Since $d_0 \notin$ *bald* is the same as $\neg(d_0 \in \phi)$, (1)′ must be true. This outcome suggests that the King of France is not bald if there is no King of France, a rather unintuitive reading, since we typically expect both (1) and (1)′ to be false or unknown in circumstances where there is no such King. A possible solution here would require the modification of the negation operator so that its output for those formulae with d_0 is either false or undefined. This modification ultimately leads to trivalent (Strawson, 1952; Kleene, 1952) and multivalent systems (Herzberger, 1973; Martin, 1977; Bergmann, 1981), both of which have consequences on the entire logical framework that are unforseen by Frege.

The first notable attempt after Frege to deal with this problem is Russell. In *On Denoting* (1905), Russell characterizes the notion of nil entity (or in Russell's own words, the *null class*[3]) as something which is used to denote the class of all "unreal

[3]Russell relates the null class to Frege in the following passage (Russell, 1905):

individuals". Russell firmly rejects the notion of unreal individuals, because to commit to the notion of some existing, yet unreal objects, such as 'the round square', 'the King of France', is "apt to infringe the law of contradiction". Instead, he proposes an alternative: Let C be a denoting phrase, say 'the term having the property F'; then the sentence "C has property G" translates to "there is one and only one term that has the property F, and that one has the property G". Thus (1) according to Russell should really be read follows:

(3) There is one and only one entity that is King of France and he is bald.

This approach exemplifies the *misleading form thesis*, according to which the grammatical form of sentences sometimes does not reflect their logical form, and is therefore misleading. The underlying cause for confusion is that definite descriptions and proper names have the same syntactic function, as 'the King of France' and 'Louis XIX' (who does not exist) are syntactically interchangeable (substitution of one for the other preserves syntactic well-formedness). Russell points out that this grammatical similarity is deceptive. A sentence such as (1) consisting of a singular definite description and a predicate is not logically a subject-predicate sentence at all, despite its grammatical subject. 'The King of France' should not be thought of as a normal NP any more than quantified expressions like *everyone* and *no one*. Instead, a definite description is a kind of 'existential proposition' and the formulae representing it should be re-written to capture the logical form of such proposition[4]. For every one-

> ...Another way of taking the same course (so far as our present alternative is concerned) is adopted by Frege, who provides by definition some purely conventional denotation for the cases in which otherwise there would be none. Thus 'the King of France', is to denote the null-class...But this procedure, though it may not lead to actual logical error, is plainly artificial, and does not give an exact analysis of the matter. Thus if we allow that denoting phrases, in general, have the two sides of meaning and denotation, the cases where there seems to be no denotation cause difficulties both on the assumption that there really is a denotation and on the assumption that there really is none.

[4]Russell makes the further claim that proper names are in fact, concealed descriptions. Consider

place predication containing a description expressed with the iota operator, we can give an equivalent formula expressed using the standard predicate logic quantifiers:

(4) $G(\iota xFx) = \exists x(Fx \wedge (\forall y(Fy \rightarrow y{=}x)) \wedge Gx)$

And this translation can be generalized to arbitrary formulas of predicate logic. (1) then, is expressed in (5). Notice how the existence and uniqueness presuppositions are explicit in the formula itself, therefore they appear in Russell's proposal as if they are *asserted*. (5) essentially entails that when the presuppositions fail, (1) is false. Since there is a truth value for every possibility, the principle of bivalence (that a formula is either true or false) is preserved.

(5) $\exists x(\text{King of France}(x) \wedge (\forall y(\text{King of France}(y) \rightarrow y{=}x)) \wedge \text{Bald}(x))$

Russell suggests that since definite NP is a quantified expression, the wide and narrow scope of the negation operator provide us with two readings for the negation of (1), (1)′:

the following:

(i) All man are mortal.
(ii) Socrates is a man.
(iii) (Therefore,) Socrates is mortal.

Traditional logic is insufficient for the deductive reasoning from (i) to (iii), because it lacks the syntax to represent (i). Even though (ii) could be represented as Man(S) where S=Socrates, the extrapolation 'Mortal(all-man)' for (i) simply won't do- we cannot arrive at (iii), Mortal(S), with it. Frege improved the syllogistic logic system by introducing quantifiers which gives (i): $\forall x\ \text{Man}(x) \rightarrow \text{Mortal}(x)$. Russell expanded this further by claiming that proper names too, may be viewed as quantified expressions:

$\exists x(\text{named-Socrates}(x) \wedge \text{Greek}(x) \wedge \text{philosopher}(x) \wedge \text{mentor-of-Plato}(x) \wedge \ldots \wedge \forall y((\text{named-Socrates}(y) \wedge \text{Greek}(y) \wedge \ldots) \rightarrow y{=}x))$

(5)′ $\exists x(\text{King of France}(x) \wedge (\forall y(\text{King of France}(y) \rightarrow y{=}x)) \wedge \neg\text{Bald}(x))$

(5)″ $\neg(\exists x(\text{King of France}(x) \wedge (\forall y(\text{King of France}(y) \rightarrow y{=}x)) \wedge \text{Bald}(x)))$

The narrow scope (5)′, is a more plausible reading for (1)′. It states that there is a King of France, but he is not bald. If there is no King of France, (5)′ will be false. (5)″ on the other hand, states that there is no King of France who is bald. If there is no King of France, (5)″ is true. As it turns out, it is ambiguous whether (1)′ should be true or false in Russell's approach.

Strawson (1950) had a very different take on Frege's legacy. First, Strawson makes the distinction between a *sentence* and the *use* of a sentence. The key difference lies in that a sentence does not have a truth value, but rather, is *used* either truthfully or falsely depending on the world/circumstances/context of the utterance. A sentence is only true or false when it is used to make a true or false assertion, or to express a true or false proposition. A referring expression does not refer to anything, it is the different uses of it that will result in different references. For example, when (1) is used by someone during the reign of Louis XVI, it is either true or false. According to Strawson, Russell's mistake was that he did not distinguish between the reference of a sentence, what it captures (a proposition), and its meaningfulness. Just because a sentence in some circumstances *could* be used to say something true or false, or an expression in some circumstances *could* be used to refer to something, does not mean that the sentence can always be used to say something true or false, or that the expression will always refer to something when it is used. When (1) is uttered at a time when France is a republic, "the question of whether it's true or false simply doesn't arise" in Strawson's own words, because under such circumstances, (1) would be "a spurious use of the sentence, though we may or may not mistakenly think it a genuine use". An appropriate reaction of a French citizen under the republic would be: "but there is no King of France", that is neither a denial nor a confirmation of (1), because, contrary to Russell, the existence of 'the King of France' was never asserted.

For Strawson, the meaning of a sentence does not depend on there being a referent for the definites in it. There is an important point raised by Strawson that has met the approval of many linguists: The *meaning* of a sentence is *not* identified with the proposition it expresses; the meaning of an expression is not about its denotation on a particular occasion, but "about the rules, habits, conventions governing its correct use, on all occasions, to refer or to assert". In other words, the meaning of an expression depends on the *context of use* of that expression. By 'context', Strawson meant "the time, the place, the situation, the identity of the speaker, the subjects which form the immediate focus of interest, and the personal histories of both the speaker and those he is addressing". An expression imposes certain requirements on the context so that it can be correctly applied, either to refer to an entity or to have a truth value. So when the definite determiner 'the' is uttered, the speaker willingly implies Russell's existential and uniqueness requirements as being fulfilled.

Russell's *Theory of Descriptions* focuses primarily on the logical form of expressions involving denoting phrases, how denoting phrases like definite descriptions can be translated to Frege's predicate logic formulae. If a denoting phrases fail to refer to something, its formula is simply false. Unfortunately, this approach underestimates the importance of context and the role in which presuppositions play in language. Definite descriptions in particular, have been known to be used like demonstratives ("the table" can be used to refer the unique table in the room when the discourse takes place in a room with that particular table), and anaphorically ("the table" used to refer to a unique table that was mentioned earlier in the discourse). In both cases, the reference depends on the context and what is presupposed in that context.

It was not until Strawson (1964) that the term 'presupposition' is brought back to the discussion. Strawson states:

> The sense in which the existence of something answering to a definite description used for the purpose of identifying reference, and its distinguishability by an audience from anything else, is presupposed and not asserted in an utterance containing such an expression, so used, stands

absolutely firm, whether or not one opts for the view that radical failure of the presupposition would deprive the statement of a truth-value.

A 'presupposition' is distinguished from an assertion in that unlike assertions, an utterance S_1 *presupposes* S_2 when the truth of S_2 is the prerequisite for the determination of the truth value of S_1. But whether S_2 is the case is never made explicit in S_1 itself. S_1 is an assertion, and S_2 is its presupposition. If (1) is considered an assertion, then "there is a unique King of France" is its presupposition. If there is no such King, (1) would be neither true nor false, according to Strawson- it would be *meaningless*.

1.2 What is a Presupposition?

It was only after the Russell-Strawson debate that linguists have taken a serious interest in the subject of presuppositions. 'Presuppositions', to put it in layman's terms, are statements that are tacitly assumed to be the case. To presuppose something is to take something for granted when making an assertion. Looking back to our earlier example, to assert (1) is, at the same time, to assume that there is a King of France. To put it another way, presupposition is a commitment made by the speaker, a commitment similar to that of making a promise. The speaker who makes a presupposition is expected to behave *as if* he believes the presupposition is true. In Stalnaker's words: "A speaker presupposes that P at a given moment in a conversation just in case he is disposed to act, in his linguistic behavior, as if he takes the truth of P for granted"(Stalnaker, 1973, p. 448)[5].

If we take presuppositions as a matter of how utterances depend on *assumptions*

[5] A distinction should be made between being committed to a presupposition, and actually believing it to be true, since a person telling a fairy tale may be committed to various fantasies throughout the duration of his storytelling, but nevertheless he does not need to believe in any of the fantasies being true.

by some agent, then presupposition appears to be a purely *pragmatic* phenomenon. Although some linguists like Kartunen (1974), Stalnaker (1974), and Gazdar (1979) have indeed approached presupposition from a pragmatic point of view, as we will see in the following sections, the ground work laid by Frege and Russell are purely *semantic*, and this is where I would like to begin. It would probably be more prudent to start with a disclaimer before exploring either of these two notions of presupposition: In the linguistic and philosophical literature, the distinction between the pragmatic and semantic descriptions of presupposition is often not drawn with the precision it deserves, so in this chapter I will try to draw a clear distinction between these two notions. Nevertheless, one of the primary goals of this dissertation is to try to synthesize some of the existing pragmatic *and* semantic approaches to the phenomenon of presupposition (and perhaps, to extend it to meanings in general). On the one hand, utterances are analyzed utilizing a dynamic semantic framework which is Fregean in that it assigns utterances truth conditions in the contexts in which they appear. But on the other hand, those truth conditions are partial in that an utterance is assigned truth conditions only for those contexts in which its presuppositions are satisfied. This very notion of context is a formalization of the conditions which are assumed by the speaker.

Let me begin with the notion *Semantic Presupposition*: The classical semantic characterization of presupposition is as a binary relation between a pair of sentences: When sentence ϕ contains a presupposition ψ, a binary relation written in subscript notation ϕ_ψ is to be read as 'the assertion ϕ carrying the presupposition ψ' (Beaver, 1997). For (1), ϕ is the assertion that "the King of France is bald", and ψ is the presupposition that "there is a unique King of France". It was pointed out by Strawson earlier that the truth of a presupposition is the prerequisite for that utterance to have a definite truth value. In other words, the truth condition of ϕ can only be determined when ψ *is true*. Essentially, an assertion always entails its presupposition, $\phi \vDash \psi$. So "the King of France is bald"$\vDash$"there is a unique King of France". The difference between classical entailment and presuppositional entailment however, is that embedding ϕ_ψ under negation, modality, or in the antecedent of a conditional will preserve the presuppositional entailment, but not necessarily the classical entailment relation. Take the following example, after Frege (1892):

(6) a. Whoever discovered the elliptic form of the planetary orbits died in misery.
b. It is not the case that whoever discovered the elliptic form of the planetary orbits died in misery.
c. It is possible that whoever discovered the elliptic form of the planetary orbits died in misery.
d. If whoever discovered the elliptic form of the planetary orbits died in misery, he should have kept his mouth shut.
e. Somebody died in misery.
f. Somebody discovered the elliptic form of the planetary orbits.

(6e) is entailed by (6a), while (6f) is the presupposition of (6a). (6a)$\vDash$(6e) and (6a)$\vDash$(6f). This, however, is as far as the similarity goes. None of (6b)-(6d) entail (6e), but nevertheless they all entail (6f).

Certain words and grammatical constructions in natural language are commonly considered *presupposition triggers*, because whenever these words or constructions appear in a sentence, they signal that the sentence contains presuppositions. It is important to note that there are certain presupposition triggers which are such that if their presuppositional content is not fulfilled (not true), then the truth condition of the entire sentence in which these triggers appear cannot be determined. Definite NPs belong to this class of presupposition triggers. The property described here, where the failure of presupposition causes the sentence to fail (to have a truth value), is not shared by all presuppositions. Take for example, focus articulation or iterative adverbs. In these cases, the sentence will remain interpretable, and have truth value, even when the presuppositions triggered turn out to be false. The following is a compilation of most, if not all of the known types of presupposition triggers in English (I will always use ϕ to designate a sentence containing the presupposition ψ):

Definite NPs: This class includes definite descriptions, proper names, demonstratives, and possessives. As we have seen, definite descriptions are the presupposition triggers that gave the initial impetus to discussions of presupposition. Hence, the amount of literature dedicated to the Definite NP is immense, e.g. Strawson (1950; 1964), Russell (1905; 1957), Heim (1983b), Neale (1990), van Eijck (1993), Roberts (2003), Kamp, Reyle, and van Genabith, J. (2008), etc.

ϕ_1 (assertion): The King of France is bald.
ψ_1 (presupposition): There exists a unique individual who is the King of France.

ϕ_2: John's kids are model students in school.
ψ_2: John has kids.

Quantifiers: A quantifier presupposes the existence of some salient domain in context which satisfies the descriptive content of the adjoining head noun to the quantifier. See e.g. Lappin and Reinhart (1988), von Fintel (1995), Abusch and Rooth (2000), etc.

ϕ_3: All delegates have voted.
ψ_3: There are delegates.

Factives: Factive verbs presuppose that the proposition of the complement is true. See e.g. Kiparsky and Kiparsky (1970), etc.

ϕ_4: John regrets that Mary left the party early.
ψ_4: Mary left the party early.

It-Clefts: 'It-cleft' is a sentence of the form: "it was x that y-ed" where x is a DP and y is a verb or VP. An it-cleft presupposes that something or somebody did y. See e.g. Delin (1989; 1992), etc.

ϕ_5: It was last summer when John went to Holland.

ψ_5: John went to Holland.

Wh-Clefts: 'Wh-cleft' splits the standard Subject-Verb-Object structure of a sentence (in English) into two parts, with one of the sentence's parts beginning with a word that starts with a wh-word. Wh-clefts has the form: "wh- X was Y" where X is a sentence from which the wh-word has been extracted, and Y is a NP or a clause. A wh-cleft presupposes that X took place.

ϕ_6: What John ordered was a pair of cowboy boots.

ψ_6: John ordered something.

ϕ_7: What happened was that John ordered a pair of cowboy boots.

ψ_7: Something happened.

Wh-Questions: Wh-Questions presuppose the existence of some entity that satisfies or answers the question, or alternatively, the questioner believes that some entity satisfies or answers the question. See e.g. Belnap (1969).

ϕ_8: What did John order?

ψ_8: John ordered something (or the person who asked the question thinks that John ordered something).

Counterfactual Conditionals: They presuppose the falsity of the antecedent, discussions can be found in Karttunen (1971), Kartutunen and Peters (1979) etc.

ϕ_9: If the road signs had only been written in both English and German, little Johan wouldn't have gotten lost.

ψ_9: The road signs were not written in both English and German.

Intonation/Focus Articulation: Stressed or destressed materials sometimes are thought to be presupposition triggers. Rooth (1987), Büring (1995), etc.

ϕ_{10}: [JOHN]$_F$ sneezed.

ψ_{10}: There are people other than John in the context who could have sneezed.

Sortally Restricted Predicates/Meaning Postulates: Seuren (1988), Kamp and Roßdeutscher (1994), Asher (2010) etc.

ϕ_{11}: John is a bachelor.

ψ_{11}: John is an adult male.

Accomplishment and Achievement verbs: Verbs that mark accomplishments and achievements are telic, and they presuppose certain preconditions for those accomplishments/achievements to be met. Accomplishments generally have a duration (e.g. 'write a letter', 'repair a car'), or a preparatory stage, while achievements do not (e.g. 'arrive in London', 'win the game'). These verbs may be considered as special types of sortal restriction. Typical examples are 'paint', 'repair' (accomplishments), 'arrive' and 'stop' (achievements), all tend to presuppose an initial state, for example 'repair' has the presupposition that the object in question is broken, or un-repaired, and 'stop' has the presupposition that the object that is stopping was moving prior to coming to a stop. See e.g. Lorenz (1992).

ϕ_{12}: The clock is repaired.

ψ_{12}: The clock was broken before it got repaired.

Temporal and Aspectual Modifiers: Temporal modifiers like 'still X-ing', 'before X-ing', and aspectual modifiers such as 'stop X-ing', 'start X-ing', where X is a verb complement to the modifier. All of them carries the presupposition of some initial state prior to the utterance. See e.g. Heinåmåki (1972), Freed (1979), van der Auwera (1993).

ϕ_{13}: John has stopped smoking.

ψ_{13}: John was a smoker.

Iterative Adverbs: These are words like 'too' and 'again', which are supposed to presuppose something such as an event or a state being repeated. Kamp and Roßdeutscher (1994), Zeevat (1994), van der Sandt and Huitink (2003), etc. Beaver (2001) also points out that these adverbs may also be seen as extending below the lexical level to the morpheme 're-'.

ϕ_{14}: John had dinner in New York too.
ψ_{14}: Someone else besides John who is salient in the context also had dinner in New York.

Others: Horn (1969), Krifka (1992), etc. This list of presupposition triggers is by no means exhaustive.

ϕ_{15}: Only John left the room.
ψ_{15}: There are other people besides John who are in the room.

ϕ_{16}: John is a far better violinist than Mary
ψ_{16}: Mary is a violinist.

Although it is difficult to pin down the whole spectrum of presupposition triggers in the English language, there are what is known as the 'embedding tests' typically utilized by linguists to detect presuppositions. The way in which these embedding tests work is as follows: when a sentence ϕ which entails a proposition ψ is embedded under certain predicates or syntactic constructions, and ψ is a presupposition, then the embedding sentence should entail ψ. If ψ is not a presupposition of ϕ, then entailment is in general not preserved after such embeddings.

Embedding test 1, embed ϕ under negation: $\neg(\phi)$, e.g. "It is not the case that ϕ".

$\neg(\phi_1)$ The King of France is *not* bald.
$\neg(\phi_2)$ John's kids are *not* model students in school.

$\neg(\phi_3)$ *Not* all delegates have voted.

$\neg(\phi_4)$ John does *not* regret that Mary left the party early.

$\neg(\phi_5)$ It was *not* last summer when John went to Holland.

...

Embedding test 2, embed ϕ in the antecedent of a conditional construction: "If ϕ then δ" (δ is a sentence that does not entail ψ).

If ϕ_1 then δ: If the King of France is bald then there will be panic in the country.

If ϕ_2 then δ: If John's kids are model students in school, then John will be happy.

If ϕ_3 then δ: If all delegates have voted then the results will be out tomorrow.

If ϕ_4 then δ: If John regrets that Mary left the party early, then Mary might call him tomorrow.

If ϕ_5 then δ: If it was last summer when John went to Holland, then Mary must have gone to France.

Embedding test 3, embed ϕ under an operator of modal possibility: "Perhaps/Maybe/It is possible that ϕ".

Maybe ϕ_1: Maybe the King of France is bald.

Perhaps ϕ_2: Perhaps John's kids are model students in school.

It is possible that ϕ_3: It is possible that all delegates have voted.

Maybe ϕ_4: Maybe John regrets that Mary left the party early.

Perhaps ϕ_5: Perhaps it was last summer when John went to Holland.

Embedding test 4, ϕ appears in a non-assertive speech act utterance. Some examples are: "I guess ϕ", or "unless ϕ, δ".

I guess ϕ_1: I guess the King of France is bald.

Unless ϕ_5, δ: Unless it was last summer when John went to Holland, I don't think I have met him before this year.

Embedding test 5, ϕ appears in an imperative. Some examples are: "make sure that ϕ!", "ϕ must be δ!" (the speaker expressing his wish that ϕ be δ).

Make sure that ϕ_1!: Make sure that the King of France is bald!
Make sure that ϕ_4!: Make sure that John regrets that Mary left the party early!
ϕ_6 must be δ!: What John ordered was a pair of cowboy boots and they must be returned!

Embedding test 6, Sentences involving expressions of the form "either ϕ_ψ or $\delta\ldots$" and "neither ϕ_ψ nor $\delta\ldots$" (δ should not explicitly deny ψ).

Either ϕ_1 or δ: Either the King of France is bald, or the Queen of England is a virgin.
Neither ϕ_{11} nor $\delta\ldots$: John is neither a bachelor, nor is he married to Mary- he is married to Sue.

Embedding test 7, ϕ appears in a question. Some examples are: "did ϕ?", "is ϕ?"

Did ϕ_3?: Did all the delegates vote?
Did ϕ_{14}?: Did John have dinner in New York too?
Is ϕ_{16}?: Is John a better violinist than Mary?

It must be noted here that even though embedding tests are universally viewed as a kind of standardized method for presupposition identification, for some triggers, not all of the embedding tests can be applied to them. For instance, presupposing polarity items (van der Sandt, 1988, p. 37-39) like positive polarity item (PPI) 'still', and negative polarity item (NPI) 'too', are both difficult to embed under negation (e.g. "John did not have dinner in New York, too"). The lesson here is that we must not rely on just one or two embedding tests, but rather apply them extensively when in doubt if something is a presupposition, and relax the negation test (embedding under negation) when it is appropriate. One further step may be taken to ascertain a presupposition by exploiting its defeasibility, which I will discuss in detail shortly.

Returning to our earlier discussions regarding the entailment relationship between an assertion and its presupposition- it is evident in the examples from the list of presupposition triggers, that ψ_n is always entailed by ϕ_n ($\phi_n \vDash \psi_n$).

As a general rule, the proposition presupposed by a presupposition trigger is always entailed by the expression in which the trigger appears in, as well as all complex sentences in which the expression is embedded. This brings us to one of the most frequently discussed topic in presupposition literatures, the *presupposition projection problem*, a term which was first coined in Langendoen and Savin (1971). Much of the discussions about presupposition projection centered on explaining how presuppositions of complex sentences can be formulated in terms of the presuppositions of their parts:

> To ask about projection is to ask about the conditions under which presuppositions, no matter how initially triggered, are projected from the clauses in which they are initially introduced to higher-level sentences in which these clauses are embedded. (Chierchia & McConnell-Ginet, 1990, p. 288)

For those who take the semantic approach to presupposition, this conception fits rather nicely in the general scheme of things- ever since Frege, semanticists have been concerned with how the meaning of a complex sentence can be constructed in terms of the meanings of its parts. Under this view, the presupposition projection problem can be seen as being part of the general *problem of compositionality.*

1.3 When Presuppositions Project and when Projection Fails

We have seen that ψ can survive as an entailment under the embedding tests included in the last section even when ϕ does not. When this happens, ψ is said to be *projected* onto the overall expression. Nevertheless, ψ does not always project, and the fact that ψ sometimes fails to project does not automatically disqualify the expression which triggered ψ as a presupposition trigger. On the other hand, presupposition projection is not the same as ordinary entailment/implicature. In as much as it is entailment at all, it is a special kind of entailment. We will take a closer look at these two related but separate points here.

First, a presupposition ψ attributed to a triggering word/expression is not always entailed by the rest of the sentence that contains the trigger. In other words, ψ does not always project. There are many ways to formulate a sentence so that a presupposition trigger fails to project its presupposition. The sentences in (7) all have the same presupposition trigger, yet the triggered presuppositions projects in the (a) variations of the following sentences, whereas (b)-(f) fail to project:

(7)
a. John's kids are not model students in school.
b. John has kids, and his kids are not model students in school.
c. John doesn't have kids, and therefore his kids are not model students in school.
d. If John has kids, then his kids are not model students in school.
e. It is possible that John has kids, and (that) his kids are not model students in school.
f. Either John doesn't have kids, or his kids are not model students in school.

(8)
a. Maybe John regrets that Mary left the party early.
b. Mary left the party early, and maybe John regrets that she left the party early.

c. Mary did not leave the party early, and therefore John does not regret that she left the party early.

d. If Mary left the party early, then it is possible that he regrets that she left early.

e. It is possible that Mary left the party early, and (that) it is also possible that John regrets that she left early.

f. Either Mary did not leave the party early, or maybe John regrets that she left early.

All sentences listed in (7) contain the same presupposition triggering expression, and likewise for (8). In (7), the presupposition trigger is the possessive 'John's kids', which presupposes that John has kids, and in (8) it is the factive 'regret', which presupposes that the proposition following it "Mary left the party early" is true. The presupposition trigger in (7a), 'John's kids', despite being embedded under negation, projects its presupposition throughout the rest of the sentence. Likewise for (8a), where the presupposition that "Mary left the party early" projects through a modal embedding. Note, however, that (7b) and (8b) explicitly state the presupposition, therefore they are not just presupposed but actually *asserted*. In other words, (7b) and (8b) do not impose a presupposition related constraint on the context. Furthermore, none of the sentences under (7c)-(7f) and (8c)-(8f) entail the presupposition that was projected in (7a) and in (8a): (7c) and (8c) on the other hand, explicitly *deny* the presupposition, which according to Strawson implies that the sentence in which the presupposition is embedded fails to determine a truth condition (and thus won't have any truth value). (7d) and (8d) are instances of *local satisfaction*, which will be elaborated in a later section when the appropriate formal framework is available. (7c) and (8c), on the other hand, are instances of *genuine* presupposition cancelation, because the presuppositional contents are exactly the opposite of what's specified by the contents of the assertion, the presupposition must *not project* in order for the sentence to avoid contradiction.

(7d)-(7f) and (8d)-(8f) are special constructions of the form:

(9) a. If ψ, then ϕ_ψ.

b. It is possible that (ψ, and ϕ_ψ).

c. Either not ψ, or ϕ_ψ.

These sentential constructions help us identify presuppositions- if a proposition ψ *fails* to project from any of the constructions in (9), while at the same time it passes the embedding tests listed in the preceding section, then we may conclude that it is indeed a presupposition. This procedure is known as the PTB, or *Presupposition Test Battery* (Geurts, 1999). The strength of PTB relies on a special feature unique to presuppositions, that of its *defeasibility*, or *cancellability* (Karttunen, 1973; Gazdar, 1979; van der Sandt, 1988; Mercer, 1992), which are not found in ordinary entailments (Kempson, 1975; 1979). Defeasibility or cancellability, roughly speaking, means that when a presupposition trigger is placed within certain contexts, it does not project. This notion was clarified in Karttunen's theory of local filtering. Karttunen (1973, p. 174) lists three groups of predicates which influence the projection behavior of presuppositions embedded in a sentence:

Plugs: Predicates which block off all the presuppositions of the complement sentence. E.g. 'say', 'mention', 'tell', 'ask', 'promise', 'warn', etc.

Holes: Predicates which let all the presuppositions of the complement sentence become presuppositions of the matrix sentence. E.g. Kiparsky's factive verbs (1970), Newmeyer's aspectual verbs (1969), embedding under negation and modality (Beaver 2001, p.54). A crucial distinction between factive verbs and other hole predicates (such as embeddings under negation and modality) is that factives are *presupposition triggers themselves*. The reason why factives are holes is precisely because they presuppose their complement as being true, and this has the effect that the complement projects from its complement position, and all the complement's presuppositions project with it onto the rest of the sentence.

Filters: Predicates which, under certain conditions, cancel some of the presuppositions of the arguments. E.g. "if-then", "either-or", the PTB constructions listed in (9) belong to this category.

Karttunen's filtering conditions can be defined recursively (Beaver, 2001). Suppose we have a function ρ that maps a simple or complex sentence S onto a set of potential presuppositions attributed to that sentence (the inner workings of this function should resemble that of our embedding tests, but this need not concern us here as it has not concerned Karttunen), then the set of presuppositions that project from S, $P(S)$, given the assumption about potential presuppositions embedded in S can be defined as follows:

Definition 1, Karttunen, 1973, Hole, Plug, and Filters

1. $P(S) = \rho(S)$ for a simple sentence S.

2. When S' is a complex sentence consisting of a hole-predicate ('regret', 'not', etc.) which embeds a sentence S, $P(S') = P(S) \cup \rho(S')$.

3. When S' is a complex sentence consisting of a plug-predicate ('say', 'mention', etc.), $P(S') = \rho(S')$.

4. When S is of the form 'if A then B', or 'A and B', then $P(S) = P(A) \cup \{\mathrm{p} \in P(B) \mid A \not\models \mathrm{p}\}$.

5. When S is of the form 'either A or B', then $P(S) = P(A) \cup \{\mathrm{p} \in P(B) \mid \neg A \not\models \mathrm{p}\}$.

Here is a demonstration of how plugs, holes, and filters work:

(10) a. John has kids.

b. John's kids are model students in school.

c. John is proud$_{hole}$ that [his kids are model students in school]$^{(10b)}$.

d. John has a mistress.

e. John said$_{plug}$ to his mistress that [he is proud that [his kids are model students in school]$^{(10b)}$]$^{(10c)}$.

f. John has a lawyer.

g. John's lawyer regrets$_{hole}$ that [John said to his mistress that [he is proud that [his kids are model students in school]$^{(10b)}$]$^{(10c)}$]$^{(10e)}$.

h. If$_{filter}$ [John has kids]$^{(10a)}$, then$_{filter}$ [his kids are model students in school]$^{(10b)}$.

i. Either John has no kids, or his kids are model students in school.

j. If [John has a mistress]$^{(10d)}$, then either [he said to his mistress that [he is proud that [his kids are model students in school]$^{(10b)}$]$^{(10c)}$]$^{(10e)}$, or [his lawyer regrets [it]$^{(10e)}$]$^{(10g)}$.

Sentence embeddings are marked by superscripts which refer to the label of the embedded sentence as an independent sentence. Looking at the above set of sentences: (10a) explicitly states the presupposition of (10b), viz that John has kids. (10a) is readily presupposed by any complex sentence that embeds (10b) under a hole predicate like 'proud', as in (10c). Moreover, since 'proud' is a factive predicate, (10c) also presupposes (10b) as a whole. (10a), therefore, is presupposed by (10c): (10c) embeds (10b), $P((10b)) = \{(10a)\}$, $P((10c)) = P((10b)) \cup \rho((10\text{c})) = \{(10a)\} \cup \{(10b)\} = \{(10a), (10b)\}$.

(10c) is embedded in (10e) under the complement of the plug predicate 'said'. Using Karttunen's formula for plugs, $P((10e)) = \rho((10\text{e}))$, and $\rho((10\text{e}))$ should give us the presupposition (10d)- that John has a mistress. Note that (10e) only presupposes that John has a mistress. (10e) presupposes neither John's kids being model students nor John's having kids in the first place, because in all likelihood, John could be delusional and thinks that he has children while he has none, or he could be lying to his mistress. The presuppositions of (10c) are blocked by the plug 'said', and (10e) is true as long as John had indeed said such things to his mistress, regardless whether he has fathered children or not.

Consider also (10g), in which the plug 'said' is embedded under the hole 'regret'. 'Regret' is a factive verb, and a typical presupposition trigger, it presupposes the truth of the proposition of its embedded sentence: $P((10\text{g})) = P((10e)) \cup \rho((10\text{g})) = \{(10\text{d}), (10\text{e}), (10\text{f})\}$, since $\rho((10\text{g})) = \{(10\text{e}), (10\text{f})\}$ and $P((10\text{e})) = \{(10\text{d})\}$. (10g) therefore presupposes that John has a lawyer and a mistress, and that he *said such things* as (10c) to his mistress (i.e. (10e) is true). Again, no presupposition from those embedded under the plug projects- John's lawyer may regret that John gave his mistress the false impression that he is a father, while he is in fact childless.

(10h) is an example with the filter "if-then". Again, Karttunen's formula works seamlessly:

> **4. When S is of the form 'if A then B', then $P(S) = P(A) \cup \{\mathbf{p} \in P(B) \mid A \nvDash \mathbf{p}\}$.**

> In (10h), A = (10a) and B = (10b),
> $P((10\text{h})) = P((10\text{a})) \cup \{\text{p} \in P((10\text{b})) \mid \text{'John has kids'} \nvDash \text{p}\}$.
> And since (10a) $\in P((10\text{b}))$ and (10a) $\vDash$ (10a) (this relation is not only an entailment, but also a tautology), we may conclude that (10a) is not presupposed by (10h).

At this point, (10i) should not require the elaborate demonstration given to (10h). The negation of 'John has no kids' would be 'John has kids'. Going back to Definition 1, since 'John has kids' entails (10a), (10a) must not be considered a presupposition of the sentence as a whole.

Filters can be compounded with plugs, holes, and even other filters to form very complex sentences, and the formulae in Definition 1 can be recursively applied to determine the final projections of those sentences. So take a a sentence like (10j), which is rather hard to process, but even so, sounds quite natural:

> P((10e)) = {(10d)}
> P((10g)) = {(10d), (10e), (10f)}
> P("Either (10e) or (10g)") = P((10e)) ∪ {p ∈ P((10g)) | ¬(10e) ⊭ p} = {(10d), (10e), (10f)}
> P((10j)) = P("If (10d) then (either (10e) or (10g))") = P('John has a mistress') ∪ {p ∈ P("Either (10e) or (10g)") | 'John has a mistress' ⊭ p} = {(10e), (10f)}
>
> We may conclude at this point that (10j) presupposes that John has a lawyer, and that he said to his mistress that he is proud that his kids are model students. He may or may not have a mistress or children, the only precondition necessary for (10j) to have a truth value is that John must have a lawyer and he said such things[6].

Coming back to PTB, in order to determine if an expression is a presupposition trigger, we first apply the embedding tests, then follow up with the constructions in (9). Presuppositions do not project in those constructions. It is easy to see that constructions in (9) are cases of Karttunen's theory of local filtering. (9a) is instantiated by (10h), where the presupposition (10a) fails to project as a presupposition of the entire sentence because it is entailed by the antecedent of the conditional. (9b) has a hole predicate ('it is possible') in the first conjunct of the 'and' filter, the hole lets

[6] The readers may instinctively ask at this point: If John has no mistress nor children, how could he possibly say to his mistress that he is proud of his kids? In other words, how could (10e) project, while none of its constituent presuppositions do? Some might simply say that (10j) is *infelicitous*. I don't think this a is very convincing. The other argument may be to point out the peculiarity of the verb 'say'- that perhaps it *does not* always function as plug, because despite how certain presuppositions fail to project through it, sometimes definite descriptions *can* project, as in this example, particularly with John's kids. Generally speaking, when 'say' is taken to mean 'producing words', 'claim', then it is a plug, but when it is understood in the sense of 'assert', or 'maintains', then it behaves more like a hole. This point is perhaps noted by Karttunen in a footnote one year later as he expresses his reservations about saying verbs being plugs (Karttunen, 1974, footnote 8).

the presuppositions of its embedded sentences through, while the 'and' filter works in the same way as the "if-then" filter: if the presupposition of the second conjunct is entailed by the first, then that presupposition does not project as a presupposition of the expression overall. (93c) is an 'either-or' construction, and functions in exactly the same way as (10i) in relation to the presupposition of its disjuncts.

Seeing how presuppositions do not project in certain special constructions, it may appear as if presuppositions are cancelable. But this is not entirely true, or maybe the term 'cancelation' should be replaced by something else, since presuppositions never really disappear in the intermediate context where plugs or filters are absent. However, the idea that presuppositions are cancelable has led many to believe that they are actually generalized Gricián conversational implicatures[7]. This brings us to the second point of our discussion: presupposition projection is not the same as ordinary entailment, and one should be very cautious about the kind of implication involved in presupposition, because presuppositions are not just any kind of implicature. Linguistic presuppositions are triggered by lexical items or grammatical constructions, and for this reason it makes sense to say that a presupposition trigger is embedded, and presuppositional entailments project from an embedded position. Conversational implicatures, on the other hand, are licensed by *utterances* in *particular contexts*. Unlike presuppositions, conversational implicatures are not necessarily associated with linguistic forms, and for this reason, it is a categorical mistake to speak of implicatures as projecting from embedded positions (Geurts, 1999)[8]. In addition, a conversational implicature does not have the same kind of strength of logical entailment as pre-

[7]Atlas and Levinson (1981) for example, have claimed that the presuppositions triggered by it-clefts are in fact conversational implicatures, and Levinson (1987, 1997), Gundel et al. (1993) even suggest that definites and anaphora should be analyzed in terms of implicature.

[8]It can be argued that conventional implicatures are associated with certain words, and therefore demonstrate projection behavior from embedded positions. So take the example:

(i) He is an Englishman; he is, therefore, brave.

(ii) His being an Englishman implies that he is brave.

suppositions, nor is an implicature prerequisite for its triggering sentence to have a truth value (unlike most, but not all presuppositions). So take (11a), a brief exchange between two interlocutors:

(11) a. A: My car is running out of gas.
B: There is a gas station around the corner.

ϕ_{11}: There is a gas station around the corner.
ψ_{11}: The crossroads at the next corner are not blocked.

b. B: There is *no* gas station around the corner. (Embedding test 1)

c. B: If there is a gas station around the corner, then you are lucky. (Embedding test 2)

d. B: Perhaps there is a gas station around the corner. (Embedding test 3)

We begin with the assumption that the implicature ψ_{11} above is *just like a presupposition* (of B's reply in (11a), which is restated in ϕ_{11}), and compare it with how a real presupposition is supposed to behave. First, B's reply in (11a) does not necessarily guarantee ψ_{11}, i.e. ϕ_{11} does not entail "the crossroads at the next corner are not blocked". It is possible that B in fact does not know whether the road is blocked at all, and still utter ϕ_{11}. Neither is ψ_{11} a prerequisite for ϕ_{11} to have a truth value, because even if the crossroads are blocked- there may still be a gas station along the path down, and ϕ_{11} could still be true. Furthermore, if such implicatures are indeed the same as presuppositions, then they should behave in the same way with respect to the tests which we have described at length: (11b) is ϕ_{11} embedded under negation. As with all standard embedding tests, if ϕ_{11} indeed presupposes ψ_{11}, then (11b) should presuppose ψ_{11} as well. But (11b) does not entail ψ_{11} at all- if there is no gas station, it does not entail anything about the road condition. Neither

A speaker of (i) implies (ii), the word 'therefore' is said to be responsible for this implicature (Grice 1975, p. 44-45). Strict conventional implicatures are semantic- they exist due to the conventions that give individual words their meanings.

is ψ_{11} entailed by (11c) nor (11d), which are also embedding tests commonly used to identify presuppositions. ψ_{11} is *not* a presupposition of ϕ_{11}, but rather, a standard implicature. A standard implicature is a type of conversational implicature based on an addressee's assumption about the speaker, that the speaker is being cooperative by observing Grician conversational maxims (1975). Standard implicature fail all the presupposition embedding tests. Let's try a different type of implicature:

(12) a. Alexander the Great conquered most of Asia Minor.

ϕ_{12}: Alexander the Great conquered most of Asia Minor.
ψ_{12}: Alexander the Great did *not* conquer some parts of Asia Minor.

b. It is not the case that Alexander the Great conquered most of Asia Minor.

c. If Alexander the Great conquered most of Asia Minor, then *his* achievements will be remembered by all the generations to come.

d. Maybe Alexander the Great conquered most of Asia Minor.

e. If Alexander the Great conquered most of Asia Minor, then the Romans would *not* have been impressed by his achievements.

A glance over (12) reveals that ψ_{12} is not a presupposition, it simply does not behave like one- none of the (12b)-(12d) entail ψ_{12}, completely failing the embedding test[9]. The only real presupposition appears in (12c), triggered by the possessive 'his'. This is evidenced when we embed the trigger under negation, as in (12e). Again, (12e) does not entail ψ_{12}, but nevertheless, it entails some male person in the local context who has had certain achievements (aka, conquering most parts of Asia Minor), and

[9](12b), not conquering *most* of Asia Minor does not necessarily entail that there are certain parts of Asia Minor unconquered. If Alexander the Great conquered *all* of Asia Minor, then no parts of Asia Minor are left unconquered. Depending on the definition used for 'most', in many situations it can be mutually exclusive from 'all' on the grounds that it violates the cooperative principle to say 'most' when in fact, 'all' is the case. However, if we take 'most' to literally mean 'more than 50 percent', then (12b) could entail ψ_{12}. This entailment would be a coincidence rather than constituting as evidence that the implicature ψ_{12} is a presupposition though.

these achievements are memorable for those generations born after Alexander the Great.

The implicature in (12) belongs to the class of *scalar implicatures*. Scalar implicatures rest on some kind of linguistic scale. When two expressions have similar distributional properties, an utterance involving one of them tends to carry a scalar implicature to the effect that another utterance, obtained by replacing the given expression by one higher on the given scale, would not have been true. For instance, 'hot' and 'warm' can be assumed to be part of the same scale, with 'hot' higher on the scale than 'warm'; and likewise 'all' on the scale of quantification is higher than 'some' and 'most'. Specifically, in (12), the implicature is such that it is *not* the case that Alexander conquered all of Asia Minor, but instead, he only conquered *most* of Asia Minor, which is lower on the scale than *all*. The Gricean Maxim of Quantity requires that the speaker be as informative as possible (but no more informative than necessary). This means that whenever a scalar implicature is involved, a word higher on the scale tends to be preferred over the lower one if the information available to the speaker licenses it. However, accounts of conversational implicature are complicated by the fact that often an utterer of an expression involving a weaker scale has reasons for not using an expression that is higher on the relevant scale. This choice is often attributed to the speaker's lack of information as to whether the stronger utterance would be true. The lack of information on the speaker's part is further compounded by the hearer's belief about the speaker, as it is quite common for the recipient of an utterance to assume that the speaker is always speaking with his full knowledge (unless otherwise indicated). There is therefore an ambiguity between whether the speaker's utterance involving a weaker scale is fully informed, or that this is simply an assumption taken for granted by the hearer. For this reason, there is an inclination for us to presume that if a weaker word on a scale is used, then it can be assumed that the negation of the stronger one is also true. At this point, it is safe to conclude that conversational implicatures do not behave the same way presuppositions do, and in so far as they constitute a kind of entailment, they should be considered as a different kind from the one associated with presuppositions. The bottom line here is, the speaker who utters (12a) is expected to be cooperative. If Alexander the Great had indeed conquered all of Asia Minor (a proposition which entails $\neg\psi_{12}$), and the speaker knows this, then the speaker should have stated that to the best of his knowledge, failing to do so by providing partial information in a statement like (12a) is unnecessarily misleading; but even so, he cannot be accused of being *untruthful*, since (12a) is still true even if ψ_{12} is false. To give another example involving scalar implicature, consider the following:

(13) a. John ate some of the cookies.
b. John did not eat all the cookies.
c. John's mother is angry that John ate some of the cookies.

If a speaker utters (13a), the hearer, assuming he respects the Maxim of Quantity, will be tempted to conclude (13b). As we have seen already, this inference can be construed as the effect of conversational implicature. Strictly speaking, even if John had eaten all the cookies, that would not affect the truth condition of (13a). Similar to (12a), uttering (13a) with the knowledge that John ate all the cookies is misleading, but it is not wrong in the manner of making a statement that is false. Indeed, (13a) does not presuppose (13b), as (13b) clearly does not project from (13c) or that (13c) does not entail (13b). Theoretically, if (13b) is a presupposition of (13a), then it should have projected from an embedding under a hole-predicate.

According to some works in the literature e.g. Soames (1979) and Gazdar (1979), implicatures are treated exactly in the same way as presuppositions. For lack of space, I will only provide a brief and informal account of this view here. Gazdar's model is based on the notion of *satisfiable incrementation*. As opposed to Karttunen (1973), where presuppositions are recursively computed at a sub-sentence level by applying filters/plugs in a bottom-up fashion, Gazdar collects all the potential presuppositions and potential implicatures of an utterance into one set, and from that set, eliminates those members which cause inconsistency. The remainder are then 'projected' as the presupposition or implicature of the overall sentence. Inconsistency occurs when there is a member in the set of potential presuppositions/implicatures that contradicts the information in the context, entailment of the utterance, or other potential presuppositions/implicatures in the same set. Presuppositions are said to be *suspended* when they are eliminated from the set for causing inconsistency, and likewise for any implicatures.

Interestingly, Geurts (1999) points out that not only implicatures fail to project from embedded positions, but also that presuppositions cannot be suspended or blocked in the same way that implicatures can. Horn (1989) makes the following distinction between implicature suspenders and blockers:

(14) a. John ate some of the cookies, and it is possible that he ate all of them.

b. John ate some of the cookies. In fact, he ate all of them.

c. John ate some, if not all, of the cookies. (If John did not eat all of the cookies, then he ate some of them)

According to Horn, the implicature that (13b) is blocked in (14a). Because intuitively, the speaker appears to admit that he is unsure whether John ate all the cookies, so he could not have implicated that "John ate all the cookies". In (14b), since the implicature licensed by the first sentence is contradicted by the second, the implicature is suspended. (14c) is ambiguous: it can be read as saying that the speaker is uncertain whether John ate some or all of the cookies, in which case the implicature is blocked. But the speaker can also be understood as implying that John only ate some but *not all* of the cookies, which means the implicature that John ate all of the cookies must be suspended for consistency's sake. In contrast, if a presupposition trigger is placed in the same position as the source of the implicature in (14) ('some'), this presupposition is not canceled in the same way implicatures are blocked or suspended:

(15) a. ? The King of France is bald, and it is possible that there is no King of France.

b. ? The King of France is bald. In fact, there is no King of France.

c. The King of France, if there is one, is bald. (Truth conditionally equivalent of: If there is a King of France, then the King of France is bald)

(15a) and (15b) are simply infelicitous. Even if we try to apply Karttunen's filtering mechanism to them (as in Definition 1), there remains a contradiction (that there is and isn't a King of France at the same time). In both cases, presuppositional entailments fail to get eliminated like the implicatures we have been considering. In (15c) however, the presupposition 'there exists a unique King of France' is entailed by the antecedent of the conditional and gets filtered out. There may be a strong temptation to see a parallel between the way in which this presupposition is temporarily suppressed and the way in which implicatures are blocked in the same construction. But Geurts argues that this does not provide enough evidence to equate presuppositions and implicatures. If they really were the same, then we should expect implicatures to behave much more like presuppositions and *not* get suspended when the antecedent of the conditional does not entail them:

(16) a. If there is a King of France, then the King of France is bald. (truth conditionally equivalent of (15c))

b. If the Ottoman Empire invented bread rolls, then the King of France is bald.

c. If the Ottoman Empire invented bread rolls, then John ate some of the cookies.

The presupposition in (16b) projects from the consequent position of the conditional, whilst the implicature that John did not eat all the cookies in (16c) disappears under the same embedding. Notice how (16b) is a typical filter construction, and presuppositions ought to project from the consequent position when they are not entailed by the antecedent. It follows that scalar implicatures, along with other types of conversational implicature, do not behave like presuppositions at all, and therefore are not presuppositions.

1.4 the Pragmatic View of Presuppositions

Semantic theories of presupposition tend to center around the projection behavior of the presuppositions triggered by particular words or grammatical constructions. Linguists study the linguistic form of expressions, the semantic evaluation and their entailment relations. This view of presuppositions contrasts with what is usually referred as the *pragmatic view of presuppositions*, which was also first formulated around the 1970s. Pragmatic theories generally take presuppositions to be propositions which the speaker takes for granted as part of the background information, which is why presuppositions are also referred as *speaker presuppositions* in pragmatic theories. In this sense, presuppositions are considered presuppositions of *utterances* as opposed to sentences or words (as they are in semantic theories). Some linguists take the view of speaker presuppositions to its extreme, for example, Stalnaker (1974) omits linguistic forms completely in his discussion about presuppositions. Stalnaker believes that presuppositions are simply propositions taken to be true by the speaker on a given occasion. For others who are less radical, while linguistic form still plays a role in pragmatic theories, they also make an essential use of the notion of a *context*. A presupposition is either held to be a relation between an utterance and the context in which the utterance takes place (Strawson, 1950; Soames, 1989), or it can be viewed as a set of constraints imposed on the context, selecting a class of contexts in which a presupposition triggering expression can be felicitously uttered (Karttunen, 1974). In this section I would like to give a very concise account of some of the most important work that has been done in the area of pragmatic approaches to the problem of presuppositions.

To start off, it was said that presuppositions sometimes fail to project in certain embeddings. Karttunen (1973) described these cases as cases of local filtering, and gave us the notions found in Definition 1 to predict when presuppositions project and when they don't. But that turns out to be only half of the story. In the very same paper, Karttunen takes an important departure from traditional semantic approaches in admitting that these filtering conditions must be relaxed, because the speaker's assumptions can change the way in which projections behave. He gives the following example:

(17) Either Geraldine is not a Mormon or she has given up wearing holy underwear.

(17) is uttered by Geraldine's friend, Fred, who is under the impression that:

(18) All Mormons wear holy underwear.

Uncertain as to whether Geraldine is a Mormon, Fred, voyeuristically, took glimpses of her while she undressed, and to his disappointment he saw that she only wore regular underwear. Fred thus gave vent to his disappointment by saying (17). The second disjunct of (17), by virtue of the presupposition trigger 'give up', presupposes that Geraldine *is* a Mormon. But it is impossible for Fred to presuppose this if he is actually uncertain of it. After all, Fred's utterance suggests that she may not be a Mormon in the first place. The problem, as Karttunen puts it, is that the negation of the first disjunct does not entail the presupposition of the second disjunct, because if it had, the presupposition would have been eliminated according to formula 5 of Definition 1. His way of getting around this problem is to include Fred's belief stated in (18) as an additional premise to the negation of the first disjunct. So if the presupposition of the second disjunct is entailed either by the negation of the first in combination with the speaker's belief, then it does not project. In this example, the negation of "Geraldine is not a Mormon" is "Geraldine *is* a Mormon". If Geraldine is a Mormon and Mormons are supposed to wear holy underwear, then Geraldine may have indeed given up wearing holy underwear, as she has worn holy underwear before. We have therefore succeeded in eliminating the projection from the second disjunct of (17), which is really a kind of local satisfaction (discussed in a later section). Karttunen then goes on to revise all of his filtering conditions with the additional premises regarding the speaker's assumptions:

Definition 1′, Filters, with Context

Let X be a set of propositions assumed by the speaker.

4′. When S is of the form 'if A then B', or 'A and B', then $P(S) = P(A) \cup \{p \in P(B) \mid X \cup \{A\} \nvDash p\}$.

5′. When S is of the form 'either A or B', then $P(S) = P(A) \cup \{p \in P(B) \mid X \cup \{\neg A\} \nvDash p\}$.

Just what precisely does the set of assumptions X consist of? Karttunen fell short of explaining this, leaving the readers with the following remarks[10]:

> We can no longer talk about the presuppositions of a compound sentence in an absolute sense, only with regard to a given set of background assumptions... The acceptance of our filtering conditions forces one to give up any hope of constructing a presuppositional language with truthfunctional connectives, which is a more radical departure from classical logic than what at least some proponents of the semantic definition have envisioned (e.g. see Keenan, 1972). (Karttunen 1973, p. 185)

Karttunen recognized that there are insurmountable limitations to dealing with the presupposition problem in purely semantic, truth conditional terms. Instead of trying

[10] Strikingly, Karttunen (1973, p. 184) also took note of what is later considered presupposition accommodation:

(i) If Nixon appoints J. Edgar Hoover to the Cabinet, he will regret having appointed a homosexual.

Karttunen points out in contexts where it is already known that Hoover is a homosexual, there is no presupposition in (i): If we add this information (Hoover is a homosexual) into the antecedent or the global context, then the presupposition attributed to the factive is filtered, or as we shall call it later, *locally satisfied*. Suppose we take a different perspective: If the hearer is not aware that Hoover is a homosexual, then it would be required of him to believe this is the case if (i) is to be felicitous. This is a classic example of accommodation, even though this term was not available at the time.

to include the speaker's assumptions by further augmenting his own semantic account from 1973, Karttunen (1974) takes a completely different point of view, defining presuppositions in terms of the class of contexts that satisfies/admits them[11]. He argues that the context is enriched by successively applying constraints to it in such a way that all the presuppositions of the incoming sentence are satisfied/admitted. The final context is a set of propositions that is equivalent to the result of explicitly computing the presuppositional projections of compound sentences. Instead of asking: "What are the presuppositions of an utterance?", the question is turned on its head: "What would the context have to look like in order to satisfy those presuppositions?" A formal definition of this theory is in order. Let C be a set of propositions which are true in the context C (I will refer to C in this section as "the context"). The effects of the plug, hole, and filter found in Definition 1 can be recaptured as in Definition 2:

Definition 2, Karttunen, 1974, Context Admission/Satisfaction

1. Let the operator $\rhd$ denote Karttunen's notion of "admission". Context C "admits" a simple sentence S just in case C entails all of the presuppositions of S: $C \rhd S$ iff $C \vDash P(S)$.

2. When S' is a complex sentence consisting of a "transparent" verb- Karttunen's (1973) term for hole predicates: factives, semi-factives, modals, aspectual verbs, internal negation, etc.- which embeds a sentence S, then $C \rhd S'$ iff $C \rhd S$.

3. When S' is a complex sentence consisting of an "opaque" verb- these

[11] *Satisfaction* and *admission* are terms used almost interchangeably. Karttunen (1974) states: "A theory of presupposition is best looked upon as the theory of constraints on successive contexts in fully explicit discourse in which the current conversational context *satisfies-the-presupposition-of*, or let us from now, *admits* the next sentence that increments it".

are Karttunen's (1973) terms for plug predicates: either a verb of saying (e.g. say, ask, tell, etc.), or a verb of propositional attitude (e.g. believe, fear, think, etc.), then let $B(C)$ be a set of beliefs attributed to the speaker of S' in context C, $C \triangleright S'$ iff B(C) $\triangleright S$[12].
In other words, C admits S' iff the beliefs of the speaker admit S.

4. When S is of the form "if A then B", or "A and B", $C \triangleright S$ just in case (i) $C \triangleright A$, and (ii) $C \cup A \triangleright B$ ($C \cup A$ denotes the set that results from incrementing C with the logical form of A).

5. When S is of the form "either A or B", $C \triangleright S$ just in case (i) $C \triangleright A$, and (ii) $C - A \triangleright B$ ($C - A$ denotes the set that results from taking the logical forms of A out from the set of C).

The new theory does not appear to cover more constructions than the old one. In particular, formula 5 of the above definition does not appear in Karttunen (1974), nor for that matter, in any of his later works on presupposition in the same vein. By defining presuppositions in terms of the context, or the set of conditions that must hold in context for the presupposition triggering utterance to be satisfied, Karttunen effectively side-stepped the problem with regard to speaker's assumptions altogether-Whatever presuppositions the speaker may have had in mind when she utters something, are presumably part of the context C already, but we do not know exactly *what else* C contains. This shift in perspective nevertheless begs the question: So what exactly does "the context" look like? Even though we now know what is required of a

[12]Karttunen (1974) categorizes both "verbs of saying", and verbs of propositional attitude in the same class of "opaque" verbs, but only go as far as demonstrating with his examples that the propositional attitude verbs hold the property specified here (Definition 2, point 3). The "verbs of saying" however, gets left out from the entire discussion with the exception of an example of the verb 'announce'. According to a footnote (no.8) in Karttunen (1974), it appears that he may have some reservations about "verbs of saying" (see also footnote 6 of this chapter).

context to admit certain sentences, we still do not know what constitutes the rest of the context.

A more problematic side effect in the 1974 model was pointed out by Beaver (2001, p. 83). Not only are presuppositions entailed by the context that admits them, but everything that is entailed by a context now qualifies as presupposition. This means, among other things, tautologies are presupposed by every sentence, and that the presuppositions of a sentence do not in general form a subset of the elementary presuppositions of its parts. This problem does not arise in Karttunen's (1973) filtering account, a tautology projects like any other standard presupposition when its trigger is embedded in the leftmost sub-sentence (the antecedent of a conditional sentence, or the first conjunct of "either. . . or. . . ").

Nevertheless, the pragmatic (purely speaker, contextually oriented) approach has some clear advantages over traditional semantic ones. Stalnaker (1974) gave the following demonstration:

(19) a. Suppose I realize/discover later that I have not told the truth, I will confess it to everyone.

b. Did you realize/discover that you had not told the truth?

c. Did *he* realize/discover that you had not told the truth?

There is a very strong tendency for us to suspect that the speaker of (19a) is not aware that he 'has not told the truth' as he utters this sentence. If this is indeed the case, then he is not presupposing that he hasn't told the truth despite the presence of a factive. In (19b), when one is asking this question, one indicates that she does not presuppose a particular answer either way, therefore there is no presupposition from the factive embedding. Contrast this with (19c), the same construction, but with the subject replaced by third person. (19c) *does* in fact presuppose "you had not told the truth" (Stalnaker, 1974). In a semantic theory, different rules would have to be construed for the same factive verbs in order to accommodate the different projection behaviors of the semi-factives in (19). In a pragmatic account like the one proposed by Karttunen (1974), we may allow differences in presupposition projection behavior without having to come up with separate lexical entries for the same factive verb. This is because a model based on context admission simply does not have to care whether the semantic contribution of a word is uniform or not. The semantic contributions are simply taken for granted, and the context simply has to admit it.

For another type of example, consider conjunctions. According to standard logic, 'and' is symmetric. "A and B" is true just in case A is true and B is true. We cannot predict presuppositions just on the basis of this assumption, however:

(20) a. It was John who ate the cookies, and Mary got rid of the cake.
b. Mary got rid of the cake, and it was John who ate the cookies.
c. Someone ate the cookies, and it was John who ate the cookies.
d. ? It was John who ate the cookies, and someone ate the cookies.

(21) a. If it was John who ate the cookies, then Mary got rid of the cake.
b. If Mary got rid of the cake, then it was John who ate the cookies.
c. If someone ate the cookies, then it was John who ate the cookies.
d. If John ate the cookies, then someone ate the cookies.

Each sentence in (20) and (21) contains an It-Cleft which triggers the presupposition that "someone ate the cookies". While the speaker who utters (20a) and (20b) is making this presupposition, he would not be taken to presuppose the same if he had uttered (20c). Instead, he would be asserting it. The presupposition triggered in the second half of the conjunction is locally satisfied (or "blocked"), because it is entailed by the first conjunct. Similar phenomenon occurs in the conditional statements in (21). Both (21a) and (21b) presuppose "someone ate the cookies", but (21c) does not because this is entailed by the antecedent. These examples seem to suggest that a certain asymmetry property should be assigned to conjunctive and conditional words, so that the presuppositional content of the second conjunct (or the consequent of the conditional) is excluded from the overall representation when the first conjunct (or the antecedent) entails it. However, if we look at the infelicitous sentence in (20d), its apparent redundancy which is not so different from that of (21d), cannot be explained away by simply making 'and' asymmetric, because there is no presupposition in the second conjunct. Some other solutions must be made available.

If the insight from Karttunen (1973) is that we should codify rules 4 and 5 (Definition 1) into the lexical entries of 'and' and 'if-then', then there is little semblance of these words left to their original, logical meanings. This solution appears to be *ad hoc*, because there are no reasons to regard the properties stated in rule 4 and 5 as *lexical*, and as a result of making them lexical, 'and' has the undesirable consequence of becoming non-commutative ("ϕ and ψ" no longer has the same meaning as "ψ and ϕ") (Stalnaker, 1973; 1974). The advantage of pragmatic approaches is that we are not required to rewrite the logic of those connectives. This is because pragmatic approaches, and that of Karttunen (1974) in particular, allows for the possibility that one part of a complex sentence can act as context for another part. In Karttunen (1974), utterance processing is sequential also with regard to the constituents of single sentences (Rule 4 and 5 in Definition 2). In this way, an intermediate context is established prior to the second argument clause of a binary connective (e.g. 'and', '(if…) then'), which may entail presuppositions triggered within this argument clause that are not entailed by the original context. For example, an utterance of the sentence form "A and B" in a context C is processed in two stages. First, C will expand to C' by admitting A ($C \triangleright A$ so $C \vDash P(A)$). Secondly, C' admits B ($C' \triangleright B$ and $C' \vDash P(B)$). The two stage process means presuppositions triggered by A and B are considered in different contexts. The presuppositions triggered in A should be entailed by C. Those triggered in B should be entailed by C'. Thus, if a proposition p is presupposed by B and entailed by A, then p does not 'project'- there is no need for C to entail it so long as C' does. To reiterate this formally, suppose $C \nvDash p$, if $A \vDash p$, then $A \cup C \vDash p$. Since $A \cup C = C'$, $C' \vDash p$. Let p be the only presupposition in B, then C' must admit B because $C' \vDash p$. There are no presuppositional requirement p on the part of C. It appears that the presuppositional asymmetry of conjunctive sentences is due to the fact that when we utter a sentence of this form, we tend to take the first conjunct as given when we are about to interpret the second; and likewise for conditionals where the consequent is interpreted given the interpretation of the antecedent, as in (21).

1.5 Context

What I would like to do at this point is to introduce a terminology that has been applied rather informally so far, but is of central importance in recent studies of presuppositions. The core of this terminology is the word 'context'.

In pragmatic accounts of presupposition[13], the term 'presupposition' refers to *speaker presupposition*, which is categorically a propositional attitude of the speaker. This propositional attitude is essentially a social and public attitude, in the sense that one presupposes ψ only when one presupposes that other people also presuppose ψ. To presuppose something is to take it for granted, or at least to act *as if* one takes it for granted, as part of the "background information".

The "background information" that the speakers rely on when they make presuppositions is known as the *common ground* (Stalnaker, 2002). The common ground is the mutually recognized shared information during a communication. To put it colloquially, the common ground is a set of assumptions shared by all participants of the conversation, often these assumptions are actual beliefs or knowledge of the discourse participants, in which case they are referred to as mutual beliefs, common beliefs, or common knowledge. For a belief to be a common belief for the participants of a conversation, they must not only share it, but also recognize that they share the same belief. That is, a proposition ϕ is a common belief if and only if every participant believes that ϕ, all believe that all believe it, all believe that all believe that all believe it, and so on.

[13]This view is most prominent in Stalnaker's works (1973; 1974; 1999; 2002), but traces of it may also be found in Keenan (1971), Karttunen (1974), and Grice (1989) for example.

Let me give an example to demonstrate the relation and interactions between speaker presupposition and common ground. Under the pragmatic view, an utterance is a speech act, which is a *manifest event* that is recognized by every participant of a conversation the moment it takes place. Suppose there are two people involved in a conversation, John and Mary. Mary says: “I must pick up my cat at the veterinarian”. This sentence is used appropriately in contexts where the speaker presupposes “Mary has a cat”. Assuming John and Mary are both competent speakers of English, and assuming they expect each other to speak appropriately and honestly, we take for granted that all this information is part of their common ground. When the phrase ‘my cat’ is uttered, the utterance as a manifest event will follow from the information in the common ground that it becomes a common belief that Mary believes that it is common belief that she has a cat. This is to say, as soon as ‘my cat’ is uttered by Mary, everybody knows that Mary thinks that everybody believes that she has a cat. It does not immediately follow that everybody also believes that Mary has a cat. However, if John chooses to accept what Mary had just said, voicing no objection to the presupposition, then John indicates that he too, believes that “Mary has a cat”[14]. It then becomes part of the common ground that “Mary has a cat”.

The common ground of a conversation constitutes the context against which an utterance can be evaluated. An established context in which an utterance is made is typically regarded as a set of propositions all participants take for granted. The central role that context plays in presupposition is the key distinction between pragmatic accounts of presuppositions that sets them apart from pure semantic characterizations. Within the logical-semantical tradition (e.g. multivalent accounts that began with Strawson 1952, Kleene 1952 and developed into Karttunen & Peters 1979, etc.; cancelation accounts such as Gazdar 1979a; filtering accounts such as Karttunen 1973,

[14]When Mary utters a presupposition triggering expression, Mary believes that John is “prepared to add it, without objection, to the context against which the utterance… is evaluated” (Soames 1982, p. 430). Since it is reasonable for people to expect Mary to know whether she has a cat or not, it is reasonable for her to believe that “Mary has a cat” will become accepted as part of the common ground.

etc.), the relation between an assertion and its presupposition is assumed to be like that of an entailment, and the truth condition of the assertion requires that the presupposition is true. Given a presupposition ψ of a statement ϕ, ψ is entailed not only by ϕ but also by its negation, $\neg\psi$. But presuppositions are often false, and to account for that the semantic approach eventually leads to trivalent or multivalent logic[15] (if ψ is false, then neither ϕ nor $\neg\phi$ can be true). In these systems, the logical form of the sentence in question is unchanged, but the interpretation of it is modified, while in classical two valued logic that cannot be.

Contextual factors played a limited role in these approaches, since in them, context is essentially static. In contrast, Stalnaker (2002) argues that given a sentence ϕ with a *speaker presupposition* ψ, ϕ *can* have a truth value despite its presupposition ψ being false. He maintains that different cases of presupposition should be explained in different ways, and speaker presupposition is a pragmatic phenomenon for which pure semantics cannot provide the adequate explanation. What is really new in the pragmatic approaches, however, is the possibility for *context change*, a feature which is intrinsic to social interactions such as dialogues generally. As we saw from the examples in (20) and (21), interpretations of utterances not only depend on context, but also *change given contexts into new contexts* (Groenendijk & Stokhof, 1996). To different extents, pragmatic theories that deal with the presupposition problem can be described as dynamic modeling of social interactions (interactions most commonly found in conversations between two interlocutors). Karttunen only goes as far as saying that the context must satisfy the *presuppositions of an utterance*, but remains neutral on the status of contexts. In this regard, Stalnaker (1974) differs from Karttunen, and claims that the context is constituted by the background beliefs of the speakers (*speaker presuppositions*). For Stalnaker, a presupposition p is an assumption made by a speaker, and as we saw before, in a given context, the speaker presupposes p just in case she treats p as part of the common ground she takes herself to share with her audience. Stalnaker adds, that the common ground need not always con-

[15] To avoid digressing, I only mention these proposals in contrast to pragmatic accounts. For further details on multivalence and partiality, there is an excellent summary in Beaver (2001), Chapter 2.

sist of actual beliefs of the speaker and her audience. Sometimes it consists of what speaker and audience assume as given for the sake of the given conversation. In a formal model of context, the common ground can, Stalnaker maintains, be identified with a set of possible worlds- all those worlds in which each of the propositions that make up the common ground is true. Stalnaker refers to this set of worlds as *the context set*.

When an assertion is made, information is added to the context set by eliminating those worlds where the propositions asserted are false. To demonstrate how this works, a formal definition of context set (Stalnaker, 1978) is called for, and first we need a model. Stalnaker's definition of the Common Ground is based on Kripke's modal and Hintikka's doxastic logics[16]:

Definition 3, Doxastic Modal Logic Model

A model M for a language of standard doxastic predicate logic with the doxastic operator B_i, with respect to a single agent i, consists of:

(i) a non-empty set of possible worlds W.

(ii) a binary accessibility relation R_i between the worlds of W. $w_1 R_i w_2$ is read as "w_2 is compatible with the belief state of agent i in w_1" or as "w_2 is a doxastic alternative to w_1 for i".

(iii) For each $w \in W$, a model M_w which contains the relevant information about how things are in w. To simplify things, *all worlds are assumed*

[16]For the point I am trying to make in this discussion, I will only present the relevant parts of this logical framework, I will skip the semantics of connectives, quantifiers, and modal operators except for the ones related to beliefs. I assume for the time being that the readers are already familiar with the basics of Intensional Predicate Logic. For more detail, see (Hintikka, 1962), (Kripke, 1963), (Kripke, 1979).

to share the same entities. D will be used to represent the domain of interpretation.

(iv) We assume rigid designation of proper names, that is, each proper name denotes the same individual in all possible worlds. Since we use individual constraint to symbolize proper names, this means that a constant gets assigned, as its interpretation in a given model, an element $I(c)$ of the domain D, which then is its denotation in all worlds. However, predicates may have different extensions in different worlds, so for every world $w \in W$, $I_w(P)$ is a subset of $(D)^n$ for each n-ary predicate predicate P:

A formula with only constants, of the form $P(c_1, \ldots, c_n)$ is true in w iff $<I(c_1), \ldots, I(c_n)> \in I_w(P)$.

The crucial clause of the truth definition is that for formulas of the form $B_i\phi$:

$B_i\phi$ is true in a world w of a model M iff $\forall w' \in$W, if wR_iw', then ϕ is true in M in w'.

An assignment function g assigns to each variable v a value $g(v) \in D$:

A formula of the form $P(v_1, \ldots, v_n)$ is true iff $<g(v_1), \ldots, g(v_n)> \in I_w(P)$.

In the models defined above there are entities of three basic types: e for individuals (members of the Domain D), **w** for worlds (members of the set of worlds W), and t for truth values (forming the set {0, 1} with 1 for truth, and 0 for falsity).

Certain properties of the belief relation can be captured as formal properties of the doxastic accessibility relations, R_i, in particular, Stalnaker (2002) assumes:

1. Each person's beliefs are transparent to herself- if Mary believes ϕ then she believes that she believes ϕ- agents are capable of positive introspection. This assumption is made formal by requiring the accessibility relation R_i for each and every person i to be *transitive* (if $w_1 R_i w_2$ and $w_2 R_i w_3$ then $w_1 R_i w_3$).

2. Lack of belief is also transparent: if the agent does not believe ϕ then she believes that she does not believe in ϕ- agents are capable of negative introspection. This assumption can be expressed formally by requiring the accessibility relation R_i to be *euclidean* (if $w_1 R_i w_2$ and $w_1 R_i w_3$ then $w_2 R_i w_3$).

3. Believers are assumed to have consistent beliefs. That is, the accessibility relation is *serial* (for all $w \in W$, there is a $w' \in W$ such that $w R_i w'$), (the set of possible worlds compatible with a believer's beliefs is always nonempty).

4. Beliefs may be false, so the accessibility relation R_i is in general not reflexive. If ϕ is false in w and participant i believes ϕ, then w is not a world compatible with all of i's beliefs, so we do not have $w R_i w$.

Stalnaker's notions of common belief, speaker presuppositions, and common ground are defined as follows (Stalnaker, 2002):

Definition 4, Stalnaker's Common Ground and Speaker Presuppositions

In those cases where the **Common Ground CG** consists of a set of common beliefs between members of a group G, being part of the common ground can be defined explicitly in terms of the accessibility relation R:

Let R^* be the common ancestral of the relation $\{R_1, \ldots, R_k\}$, where 1, ..., k are the members of G. wR^*w' iff for all nonempty finite sequences $< i_1, \ldots, i_n >$, where for j=1, ..., k. $i_j \in \{1, \ldots, k\}$, $wR_{i_1} \ldots R_{i_n}w'$. Then ϕ is part of the common ground of G in world w iff $\forall w'(wR^*\mathrm{w}' \rightarrow w' \vDash \phi)$.

In general, as we just noted, the common ground need not consist of belief, but only of propositions that are accepted for the purpose of the conversation. In this case we need a special accessibility relation R_a which reflects the general notion of acceptance, that is, wR_aw' iff w' entails all propositions accepted for the conversation. Then we define the relation R^* by:

wR^*w' iff for all sequences $< i_1, \ldots, i_n >$ (the empty sequence included), $wR_aR_{i_1} \ldots R_{i_n}w'$

Again, ϕ belongs to the common ground in w iff $\forall w'(wR^*\mathrm{w}' \rightarrow w' \vDash \phi)$.

We can also introduce into our doxastic logic a modal operator CG, which expresses that ϕ is part of the common ground CG:

$[\![CG\phi]\!]_w = 1$ iff $(\forall w')(wR^*w' \rightarrow ([\![\phi]\!]_{w'}=1))$

The set of presuppositions of an individual speaker, **Speaker Presuppositions**, is identified with what the speaker believes to be commonly accepted:

Recall that B_i is the doxastic operator for an agent i $\in G$. So the presuppositions according to agent i can be represented by the complex operator B_iCG: B_iCGϕ means that i believes ϕ to be true throughout the common ground, i.e., ϕ is a proposition that i takes to be presupposed. The complex operator B_iCG represents agent i's speaker presuppositions.

Suppose that K is a common ground, i.e. K is a set of worlds, and suppose that the proposition ψ is uttered against the background of K, then normally, the effect is that K is updated with ψ: the new common ground is K$\cap\psi$ (Brasoveanu, 2004):

$$K \cap \psi = \lambda w\ (K(w)\ \&\ \psi(w))$$

There are several constraints on how the CG can be updated:

(i) Rule of non-contradiction. An incoming assertion ψ must not contradict K:

$$K \cap \psi \neq \varnothing\text{, i.e. } \exists w\ K(w)\ \&\ \psi(w)$$

(ii) Rule of non-redundancy. The information carried by the incoming assertion ψ must not be redundant with respect to K:

$$K - \psi \neq \varnothing\text{, i.e. } \exists w\ K(w)\ \&\ \neg\psi(w)$$

To illustrate, suppose we are given an initial CG, K_0, and that (22) is uttered in this CG:

(22) a. John ran. $\phi = \lambda w\ ran_w(john)$

CG update: $K_1 = K_0 \cap \phi = \lambda w\ (K_0(w)\ \&\ ran_w(john))$

b. John fell over. $\psi = \lambda w\ fell.over_w(john)$

c. ? John remained immobile. $\varphi = \lambda w\ remained.immobile_w(john)$

d. ? John galloped. $\theta = \lambda w\ galloped_w(john)$

Assuming there are no contradictions and redundancies between the initial Common Ground K_0 and ϕ, K_0 is updated with the set of worlds where "John ran" is the case ($john$ is a constant in D). The new Context Set K_1 becomes the Common Ground for the next sentence:

CG update for (22b): $K_2 = K_1 \cap \psi = (K_0 \cap \phi) \cap \psi =$
$\lambda w\ (K_0(w)\ \&\ ran_w(john)\ \&\ fell.over_w(john))$

But can we also utter (22c) or (22d) in the context of K_1? The answer is 'no':

CG update for (22c): $K_2{}' = K_1 \cap \varphi = \lambda w\ (K_0(w)\ \&\ ran_w(john)\ \&\ remained.immobile_w(john))$

CG update for (22d): $K_2{}'' = K_1 \cap \theta = \lambda w\ (K_0(w)\ \&\ ran_w(john)\ \&\ galloped_w(john))$

If meaning postulates are set up properly for the words 'run', 'remain immobile', and 'gallop' (as listed below), then in the models in which (22) is interpreted, the set of those who 'run' and those who 'remain immobile' are mutually exclusive in every possible world, while those who 'run' overlaps precisely those who 'gallop'. The update of K_1 by (22c) therefore runs into the problem that in no world where John runs, he also remains immobile, thus violating the Rule of non-contradiction:

Meaning Postulate: $\forall w \forall x(run_w(x) \leftrightarrow \neg remained.immobile_w(x))$

$K_1 \cap \varphi = \varnothing$.

CG update of K_1 by (22d) faces a similar problem, since all of the worlds in which John runs, he also gallops, and vice versa. The Rule of non-redundancy therefore tells us (22d) is not felicitous in the context of K_1:

Meaning Postulate: $\forall w \forall x(run_w(x) \leftrightarrow galloped_w(x))$

$K_1 - \theta = \varnothing$.

In a nutshell, (22) demonstrates how a context can be updated by incoming sentences in Stalnaker's (1978) theory. This framework, however, is not entirely without flaws. Intuitively, the following sentences should have exactly the same impact on context as (22):

(23) a. A man ran. $\phi' = \lambda w\ \exists y\ (man_w(y)\ \&\ ran_w(y))$

CG update: $K_1{}' = K_0 \cap \phi' = \lambda w\ (K_0(w)\ \&\ \exists y\ (man_w(y)\ \&\ ran_w(y)))$

b. He (the man) fell over. $\psi' = \lambda w\ fell.over_w(x)$

c. ? He (the man) remained immobile.
$\varphi' = \lambda w\ remained.immobile_w(x)$

d. ? He (the man) galloped. $\theta' = \lambda w\ galloped_w(x)$

Indefinites in Stalnaker's framework are represented by existential quantification over entities. This means "a man ran" is represented as $\exists y\ (man_w(y)\ \&\ ran_w(y))$, as seen above. But what should the update of the context $K_1{}'$ with (23b) be like? The problem is that we do not know what to do with the pronoun 'he'. According to classical semantics, the only option is to translate 'he' as a free variable, so we get:

CG update for (23b): $K_2''' = K_1' \cap \psi' = (K_0 \cap \phi') \cap \psi' =$
$\lambda w\ (K_0(w)\ \&\ \exists y\ (man_w(y)\ \&\ ran_w(y))\ \&\ \lambda w\ fell.over_w(x))$

Here, x is a free variable, outside the scope of the existential quantification. Unlike the earlier example (22) where both occurrences of 'John' is simply translated to the constant *john*, classical semantics has no means to guarantee the anaphoric relationship between x and the existential quantifier used to represent 'a man'. As a consequence, the mechanism of CG update as outlined by Stalnaker (1978) does not capture the anaphoric dependency between the indefinite 'a man', and the pronoun 'he' (nor the definite 'the man', which to the same effect as the pronoun, is meant to be anaphorically linked to 'a man'). This leads to many problems:

(24) A man ran and fell over.
$\eta = \lambda w\ \exists y\ (man_w(y)\ \&\ ran_w(y)\ \&\ fell.over_w(y))$

If CG update is supposed to model the dynamics of growth of knowledge, then the Common Ground established by (24), as we understand it, should be exactly the same as the one established by (23a) followed by (23b). Unfortunately this is not the case, because K_2''', the update of K_0 with ϕ' and ψ', is not well-formed (due to its free variable), η does not entail K_2''' nor vice versa, but *it should*. What is worse, a CG update of K_1' by (23c) turns out to be felicitous despite the rule of non-contradiction:

CG update for "A man ran. He remained immobile": $K_2'''' = K_1' \cap \varphi' = (K_0 \cap \phi')$
$\cap\ \varphi' = \lambda w\ K_0(w)\ \&\ \exists y\ (man_w(y)\ \&\ ran_w(y))\ \&\ remained.immobile_w(x)$

Again, x is unbound, and even with the meaning postulate it is entirely possible for a man to be running in some worlds, while in these same worlds some other man, or object denoted by x remains immobile. A framework that models the successive enrichment of context by utterances must provide a mechanism to account for anaphoric dependencies. Various solutions in dynamic semantics have been proposed, the most prominent ones are (Kamp, 1981), (Heim, 1983a), and (Groenendijk & Stokhof, 1991). All three proposals offer a solution to this particular problem, two of these will be explored in detail throughout the next section, but only one adapted in the discussions throughout the rest of this dissertation.

1.6 DRT and the Anaphoric Treatment of Presuppositions

So far our discussions about the semantic and pragmatic approaches to the problem of presupposition have left one crucial question unanswered: What is the relationship between context admittance/satisfaction of an utterance, and the semantic representation of that utterance? It is no coincidence that this question brings to the literature a long standing tension in formal semantics: What is the relationship between meaning defined in terms of truth conditions, and meaning which depends on a language user's full understanding of the words and expressions she perceives? So far in our brief introduction, we have explored the possibilities as to how presuppositions of a complex sentence can be derived from its embedded sub-clauses by relying solely on a series of logical maxims (as in PTB and Karttunen, 1973). We have also witnessed how this is insufficient in circumstances where information from within the context can affect presupposition projection in ways that logical maxims alone could not have predicted. For the most part, the pragmatic theories that were presented here side-step the need to identify what exactly the information in those contexts is.

The answer to those questions constitutes the key distinction between semantic and pragmatic analyses of presupposition. These differences between semantics and pragmatics however, have become rather blurred since the early 80s, particularly since the introduction of File Change Semantics (FCS) and Discourse Representation Theory (DRT). Both of these, permit a logical and transparent representation of the context as it is cumulatively constructed from incoming utterances. One of the prerequisites for semantic representations of contexts is the apparatus used to deal with the problem of anaphoric dependency, something, as was mentioned towards the end of the previous section, that was lacking in Stalnaker's presentation.

The first solution I would like to present is the one Heim gives in terms of Context Change Potential (CCP) (Heim, 1983b). CCP is based on the framework of File Change Semantics (Heim, 1983a), which is originally motivated by the desire to address the difference in meaning between definite and indefinite noun phrases. A definite NP, as Heim emphasizes following a long tradition, is used to refer to something already *familiar* to the participants of a conversation. An indefinite, on the other hand, is used to introduce a new referent. This proposal, which Heim attributes to Hawkins (1978), is known as the "familiarity theory of definiteness". There is a small flaw in this generalization however- it assumes that definite and indefinite expressions always refer to something (in reality or in the Model). Non-referential uses of these expressions, e.g. bound variable pronouns, or definite generics, do not refer to any particular entity. Karttunen (1968; 1976) attempted to get around this problem by reformulating the original familiarity theory, replacing the standard notion of referent that must be anchored to an entity with that of *discourse referent*, something that is temporarily and mentally conjured up in the course of communication to represent the objects which are mentioned. In this new theory, a definite NP must pick out an already familiar discourse referent, whereas an indefinite NP introduces a new discourse referent. An NP may introduce a discourse referent, but not necessarily a referent. This avoids the problem caused by non-referential NPs in the original familiarity theory.

In FCS, a sentence is first parsed according to the grammar of the language into its syntactic tree (or LF in the sense of Chomsky's Government and Binding Theory (1957)). This syntactic tree is then transformed into a *function* that alters a file which exists prior to the utterance of the sentence to another file which comes into being as a result of the utterance. This function is known as the "file change potential" or "context change potential". Although Heim uses two different terms in her two closely contemporary papers (1983a; 1983b), "file" is essentially synonymous with "context". By *context*, Heim is referring to Stalnaker's notion of context: A context C is construed as a set of propositions (or more simply, as a proposition, namely that proposition which is the conjunction of all the propositions in the set). These propositions are represented by the set of worlds where they are true. A file, or a context, is evaluated against a given Model, and through this, a sentence obtains its truth value[17].

In a discourse, various entities get introduced with certain properties, and relations between them in terms of how they are characterized by the discourse. To represent these, Heim identifies discourse referents with *file cards*. A file card can be seen as a kind of theoretical construct that serves to represent entities in the discourse. To illustrate using an example:

(25) a. A woman was bitten by a dog.
b. The King of France owns the dog.
c. She_i was hurt.
d. Every woman_i who is hurt goes to her_i doctor.

Suppose there are no file cards or discourse referents prior to the utterance of (25), that is the utterance of (25) begins against the background of an empty file $\mathbf{C}_0$. Utterance of (25a) leads to the introduction of two cards by virtue of the indefinites it contains:

$\mathbf{C}_1$:

File Card 1
1 is a woman
1 was bitten by 2

File Card 2
2 is a dog
2 bit 1

[17] The Model that was outlined in Definition 3 serves as the background of our current discussion.

The file cards are metaphors for Karttunen's discourse referents just as files are metaphors for Stalnaker's contexts: An indefinite NP will always introduce a new card, while a definite NP will update an existing card. This is one way to formalize the original familiarity theory, according to which definiteness signals familiarity, and indefiniteness novelty. (25a) has the CCP that maps $\mathbf{C}_0$ to $\mathbf{C}_1$. Each file determines a proposition. A file is true in the Model M corresponding to a possible world w when the cards in it have corresponding individuals in w that satisfy the conditions written on the cards. So $\mathbf{C}_1$ is true if there are two individuals in M, such that the first is a woman in M, and the second is a dog in M, and the dog bit the woman. Otherwise, $\mathbf{C}_1$ is false in M.

The CCP, or File Change Potential attributed to an utterance, is a function from contexts to contexts. Generally speaking, CCPs are not defined for all contexts. The CCP determined by a sentence S is defined only for those contexts which *admit* S. Heim uses Karttunen's notion of 'admission' (Karttunen, 1974): A context C admits a sentence S if and only if the presuppositions of S are satisfied in each and every world w $\in$ C, or in other words, C must entail all the presuppositions of S[18]. C is defined for the CCP of S, CCP_S, when C admits S. Thus for instance, the CCP of the sentence (25b) is defined for C only if the presuppositions associated with the definite descriptions of this sentence are satisfied in C. That is, in each world w$\in$C, there must be a unique King of France and a uniquely salient dog. Suppose C is a context which verifies file $\mathbf{C}_1$, then in each w$\in$C, the file $\mathbf{C}_1$ is true (or if we identify $\mathbf{C}_1$ with the set of worlds which verify the information on its two file cards, then $C \subseteq \mathbf{C}_1$).

A special case is when the CCP of S is defined for all contexts (i.e. S has no

[18]We say that a context C satisfies a proposition ϕ iff ϕ holds in each world of C, i.e. $C \subseteq \phi$. We say that a context C *admits* a sentence S iff C satisfies all presupposition of S. Furthermore, we assume that the CCP determined by a sentence S is *defined* for only (and all) those contexts C which admits S. Instead of saying that C satisfies ϕ, I will also sometimes say that C *verifies* ϕ; these two terms are equivalent. The terms mentioned in this footnote may not coincide fully with those used by Karttunen or Heim, but they describe the same concepts that are used in their theories.

non-tautological presuppositions). In that case, S can be considered to express a proposition "in its own right". This proposition can be identified with the result of using S in an 'empty context', i.e. in the context that requires no constraints on the worlds that belong to it. This is the context W, consisting of all worlds. So the proposition ϕ expressed by S is the set $\mathrm{CCP}_S(\mathrm{W})$. Moreover, for such sentences S, the result of applying CCPs to any context C other than W is the intersection of C with ϕ, see Definition 5a:

Definition 5a, Heimian Context Change Potential (for Complete Sentences Only)

Suppose context is Stalnakerian, i.e. a context C is a set of possible worlds C. And suppose that sentence S expresses a proposition, ϕ (a set of worlds), then the update of C with S, $\mathrm{CCP}_S(\mathrm{C})$, is given by:

$$\mathrm{CCP}_S(\mathrm{C}) = C \cap \phi$$

We also write 'C + S' for $\mathrm{CCP}_S(\mathrm{C})$. But of course, in general, that is when S may have presuppositions, then CCP_S is, as we saw, a partial function. If S expresses a proposition irrespective of whether its presuppositions are satisfied, then the update function can be defined as indicated in Definition 5a: CCP_S is defined for C when C verifies the presuppositions of S, and in that case $\mathrm{CCP}_S(\mathrm{C}) = C \cap \phi$. But, as we have also seen, there are sentences S which arguably do not express a proposition unless its presuppositions are satisfied (according to Frege, Strawson, and many others, sentences with definite descriptions whose presuppositions are not fulfilled are examples).

The projection property of presuppositions with respect to the operators of classical propositional logic can be captured by recursive definitions of the CCPs of sentences built with the help of these operator from atomic sentences. But for now let us restrict our attention to those sentences that express well defined proper terms irrespective of the satisfaction of their presuppositions:

CCP$_{\text{``}not-S''}$(C) = C + "not S" = $C \setminus$ CCP$_S$(C), when CCP$_S$(C) is defined.

($M \setminus N$ stands for the intersection of M with the complement of N.)

CCP$_{\text{``}A-and-B''}$(C) = C + "A and B" = CCP$_B$(CCP$_A$(C)) = $(C \cap \phi_A) \cap \phi_B$, when CCP$_A$(C) is defined.

CCP$_{\text{``}If-A-then-B''}$(C) = C + "If A then B" = $C \setminus$ (CCP$_A$(C)) $\setminus$ CCP$_B$(CCP$_A$(C)) = $C \setminus ((C \cap \phi_A) \setminus (C \cap \phi_A \cap \phi_B))$, in cases where CPP$_A$(C) and CCP$_B$(CCP$_A$(C)) are defined.

It is important to read the clauses of this definition the way they are meant to, that is: with proper attention to what they say about definedness. Each of the right hand side of the formulae in Definition 5a is defined if and only if CCP$_S$(C) is defined, that is, when C admits the presupposition of S. The left hand side too is defined if and only if C satisfies the presuppositions of S. In other words, the Domain of CCP$_{not-S}$ coincides with that of CCP$_S$. C admits "Not S" only if C admits S too. So the presuppositions of S are also the presuppositions of "Not S". This captures Karttunen's claim that negation is a 'hole' (Karttunen, 1973). Furthermore, when CCP$_S$ is defined for C, then CCP$_{not-S}$(C) consists of just those worlds of C in which S is false. Similar observations apply to the other clauses. For the CCP of a conjunction, CCP$_{\text{``}A-and-B''}$(C), to be defined, the context must first admit A, meaning it must satisfy the presuppositions of A (or it must be accommodated in order to satisfy them), and then the resulting context is used to admit B (the resulting context must satisfy the presuppositions of B). This closely models the dynamic context change that is illustrated by examples such as (20) and (21). The above definition for the CCP of complex sentences is compositional in that the CCPs of negations, conjunctions, and conditionals are recursively defined in terms of the CCP's of their immediate constituents. In this regard, the definition of CCP resembles Karttunen's context satisfaction approach that was outlined in Definition 2.

CCPs can also be adapted to deal with expressions and presuppositions that don't express propositions, i.e. below the level of complete sentences, where a presupposition may contain free variables which are bound only externally to the sub-sentence in which it is triggered. But first, let us look at an example of non-projection of a presupposition:

(26) If John owns an apartment, then the apartment he owns is not where he lives.

"The apartment he owns is not where he lives" carries the presupposition that there is a (unique) apartment John owns. This presupposition is satisfied by the update of the context C in which (26) is uttered with the CCP of the antecedent "John owns an apartment"[19]. This illustrates a general property of conditionals as captured by Definition 5a. The CCP of a conditional "If A then B" is defined for a context C, provided that the presuppositions of A are satisfied by C, and the presuppositions of B are satisfied by the update C+A that we get by applying CCP_A to C.

In particular, on the assumption that the antecedent of (26) has no presuppositions, and the only presupposition of its consequent is that John has a unique apartment, then $\mathrm{CCP}_{(26)}$ is defined for all C which verify that John owns at most one apartment-C need not verify that John does own an apartment.

What we see in (26) is that its consequent expresses a proposition conditional upon its antecedent (together with the global assumption that John is one of those who owns at most one apartment). So the recursive clause for "if-then" in the definition of

[19]This is not quite correct. We want to accommodate so that in the worlds of the updated context there is a unique apartment John owns, and we must assume uniqueness is given in advance in that the initial context contains only worlds in which John owns at most one apartment.

CCP can still be applied. But this is no longer obvious for the universally quantified sentence in (27):

(27) a. Every one of John's female colleagues who owns an apartment doesn't live in the apartment she owns.

b. ∀x((x is a female colleague of John's ∧ x owns an apartment) → x doesn't live in the apartment x owns)

In (27), the presupposition carried by the nuclear scope of the universal quantifier 'every one', namely, the colleague in question owns a (unique) apartment, is verified by the quantifier's restrictor via its relative clause 'who owns an apartment (again, the general assumption is that no one owns more than one apartment). However, the account of presupposition projection given in Definition 5a of the CCPs of compound sentences cannot be directly applied to this case. The difficulty can be brought out when we try to formalize (27a) in predicate logic, representing the quantifier phrase 'everyone' by means of the universal quantifier ∀ and a variable x that is bound by ∀, as in (27b). The nuclear scope of the universal quantifier in (27a), which in (27b) is represented by the consequent of the conditional, carries a presupposition that we may want to represent as 'x owns a (unique) apartment'. Intuitively, this presupposition disappears from (27a) because it is satisfied by the restrictor of 'every one' (the antecedent of the conditional of (27b)). We would be inclined to say that the restrictor of (27a) provides a (local) context in which the presupposition is satisfied, just as the antecedent of (26) provides a local context that satisfies the presupposition of its consequent.

Our present CCP-based account however, cannot be applied directly to (27), because so far CCP's are defined only for complete sentences, not for sentence parts of which it has been known since Frege that their semantics must involve in one way or another the use of variables (and quantifiers as variable binding operators). The solution that Heim offers to this problem is to make the notion sensitive to variable assignments (i.e. to assignments of values to variables). The standard way in Dynamic Semantics to achieve this is to define contexts not as sets of possible worlds, but as sets of sequence-world pairs <g, w>, where w is a possible world, and g is a variable assignment (Heim calls it a 'sequence'). Thus the 'empty' context which contains no information will now be the set of all pairs <g, w>, where w is any possible world, and g is any assignment/sequence. And when we apply the CCP of 'x is a female colleague of John's and x owns an apartment' to this context, the effect is to restrict the set to those pairs <g, w> such that g(x) is a female colleague of John's in w, and g(x) owns an apartment in w. Updating of this context with the CCP of 'x don't live in the apartment x owns' is now possible since the presupposition of this, viz, 'x owns an apartment', is verified by this context- each pair <g, w> in the context is such that g(x) owns an apartment in w.

Sets consisting of pairs <g, w> are called *information states*. These are now our contexts, replacing the previous notion of a context as a set of possible worlds. But in fact, the change is more general. The notion of a proposition is replaced by that of an information state generally. For instance, the presupposition ψ carried by 'x does not live in the apartment x owns', which we described as 'x owns a (unique) apartment' can be identified with the information state consisting of all pairs <g, w>, such that g(x) owns a (unique) apartment in w. And the information state C resulting from updating the empty information state $\mathbf{C}_0$ with the information state defined by the restrictor of (27b) verifies ψ in the sense that C$\subseteq\psi$- just as before, the verification relation is set-theoretic inclusion. The new definition for CCP in terms of information states is as follows:

Definition 5b, Heimian Context Change Potential

A context C is a set of sequence-world pairs.
A sentence S, which may contain free variables, expresses a proposition ϕ_S, which is the set of pairs {<g, w>: there is an assignment g that satisfies ϕ_S in w}

CCP$_S$(C) = {<g, w>: <g, w> $\in C$ and g satisfies ϕ_S in w}

The CCP of a compound sentence formed out of simple sentences is defined recursively from the CCPs of its constituent sentences:

$\text{CCP}_{\text{“}not\text{–}S\text{”}}$(C) = C + “not S” = {<g, w>: <g, w> ∈ C, and $C \setminus \text{CCP}_S$(C)}, when CCP_S(C) is defined,

($C \setminus \text{CCP}_S$(C) stands for the set {<g, w>: <g, w> ∈ C and <g, w> ∉ CCP_S(C)})

$\text{CCP}_{\text{“}A\text{–}and\text{–}B\text{”}}$(C) = C + “A and B” = $\text{CCP}_B(\text{CCP}_A$(C)) = {<g, w>: <g, w> ∈ C, there is an assignment g that satisfies ϕ_A and ϕ_B in w}, provided that CCP_A(C) and CCP_B(C+A) are defined.

$\text{CCP}_{\text{“}If\text{–}A\text{–}then\text{–}B\text{”}}$(C) = C + “If A then B” = $C \setminus (\text{CCP}_A$(C) $\setminus$ $\text{CCP}_B(\text{CCP}_A$(C))), provided that CCP_A(C) and CCP_B(C+A) are defined,

With this new definition, let us return to (25). Let $\mathbf{C}_0$ be the context for (25a) and $\mathbf{C}_1$ be the result of updating $\mathbf{C}_0$ with this sentence. Then:

<g, w> satisfies $\mathbf{C}_1$ iff g(File Card 1) = a_1, a_1 ∈ woman, and g(File Card 2) = a_2, a_2 ∈ dog in w. g(<a_2, a_1>) ∈ Bite, in w. $\mathbf{C}_1$ consists of all the sequence-world pairs that satisfy those conditions[20].

[20] Keeping true to Heim's original writing: g is a function from the set of natural numbers ℕ to the domain of individuals. The sequence <a_1, a_2> is the function which maps 1 to a_1, and 2 to a_2. Heim represents the set of all sequences that satisfy a given file by Sat(F). Sat(F) is called “the satisfaction set of F”:

Sat(F) $=_{def}$ {a_N: a_N satisfies F}, where N is a natural number and stands for the domain of the sequence F.

Card numbers used in a given file are represented as Dom(F).

(25b) contains a presupposition that "there exists a unique King of France". If there is no King of France, he could not possibly own the dog which bit the woman mentioned in (25a)[21]. Following our definitions, $\text{CCP}_{(25b)}$ is defined for the context $\mathbf{C}_1$ if and only if $\mathbf{C}_1$ admits (25b), this is, if $\mathbf{C}_1$ satisfies the uniqueness and existence presuppositions associated with 'the King of France'. (25b) is defined in $\mathbf{C}_1$ if every sequence-world pair in $\mathbf{C}_1$ satisfies these presuppositions, undefined otherwise. And for those contexts where (25b) is defined, it is true if the King indeed owns the dog that bit the woman in (25a). The new file $\mathbf{C}_2$ that results from the utterance of (25b):

$\mathbf{C}_2$[22]:

A file F is true if there is a satisfying sequence for the cards in it:

F is true iff $\text{Sat}(F) \neq \varnothing$ (and false otherwise)

Heim then defines CCP and the difference between definites and indefinites using the above definitions. But since these notions unnecessarily complicate things, I will leave them out of the current discussion and only mention them as part of the footnote. It would not matter very much if we do away with natural numbers here and simply regard g as a function that assigns variables in the the formula (a formula that represents the utterance of (25a), for example) to individuals in the domain of interpretation.

[21]'The dog' here refers to 'a dog' in (25a). There is the issue of anaphoric resolution from 'the dog' to 'a dog' that is not raised here. As we will see in the upcoming discussion on this very topic, Heim simply assumes this to be taken care of by syntax.

[22]Heim (1983b) says next to nothing about the uniqueness presupposition of definite NP's. The uniqueness presupposition will be elaborated in DRT in the following chapters. For the meantime, we will simply treat it as if it is a regular predicate.

File Card 3 is obviously an instance of presupposition accommodation. Again, Heim has nothing to say about accommodation. File Card 3, however, is a necessary extrapolation (on my part) in order to make full sense of the CCPs of sentences containing presuppositions.

File Card 1	File Card 2	File Card 3
1 is a woman	2 is a dog	3 is a King
1 was bitten by 2	2 bit 1	There is only one King in w
	2 is owned by 3	3 owns 2

<g, w> satisfies $\mathbf{C}_2$ iff g(File Card 1) = a_1, $a_1 \in$ woman; g(File Card 2) = a_2, $a_2 \in$ dog in w; g(<a_2, a_1>) $\in$ Bite; g(File Card 3) = a_3, $a_3 \in$ King and there is only one King; g(<a_3, a_2>) $\in$ Own.

Heim deals with universal sentences such as the one in (25d) with the following CCP for 'every':

Definition 6, Heimian Universal

C + Every x_i, A, B = {<g, w> $\in$ C: $\forall$a (<$g^{i/a}$, w> $\in$ C+A $\rightarrow$ <$g^{i/a}$, w> $\in$ C+A+B)}

$g^{i/a}$ represents the assignment function that is identical to g, except that $g^{i/a}$(i) = a. This means the file card with the index i is assigned to a in the Domain. Another stipulation that is essential for universals to have the correct truth conditions is that x_i must be a new variable and i a new file card, introduced when the universally quantified NP is uttered. Karttunen (1968; 1976) specified a number of characteristics about discourse referents, with regard to how they are introduced and to the factors which determine their lifespan. The one which applies to (25c) are that a new discourse referent is introduced for every universal quantification, and that discourse referents which are introduced on this ground will not be available beyond the scope of the universal quantifier. Heimian Universal is applied when a context C is updated by the sentence "Every (x_i) A, B". First, the sequence-world pairs <g, w> in C will have to admit the restrictor A. In the process of this admittance, the denotation of the file card i is fixed by g as a, resulting in a new context with the sequence-world pair <g$^{i/a}$, w>. This sequence-world pair <g$^{i/a}$, w> must then admit the nucleus B. This approach closely resembles the way in which conjunctions are admitted in Definition 5a. The CCP of C+"Every (x$_i$) A, B" is defined for a context C only if the CCPs for C+A and (C+A)+B are also defined. Applying these to (25d), the context C must admit (i) x$_i$ is a "woman who is hurt", (ii) C+"woman who is hurt" admits "x$_i$ goes to see x$_i$'s doctor". Assuming (i) is satisfied, the updated context C+"x$_i$ is a woman who is hurt" will be C ∩ {<g, w>: g(i) is a woman who is hurt in w}. (ii) will be satisfied if this updated context admits "x$_i$ goes to see x$_i$'s doctor", that is if the following is true:

For every <g, w> ∈ (C ∩ {<g, w>: g(i) is a woman who is hurt in w}), g(i) has a unique doctor.

So for (25d) to be true in C, it must be the case that whenever there is an injured woman in the local context (where g(i) is fixed to the injured woman), for every such woman, there is a unique doctor who treats her. Effectively, this means (25d) presupposes that every woman has a doctor. This prediction about universally quantified sentences where the presupposition trigger is in the nuclear scope coincides with Karttunen & Peters (1979). If B presupposes P, then "every A, B" presupposes "every A, P". Now let us look at another example where the presupposition trigger is located under the scope of the restrictor. Consider (28a):

(28) a. Everyone$_i$ who serves his king will be rewarded.

b. No nation cherishes its king.

There is a strong intuition that (28a) says that everybody who has a king and serves him will be rewarded, 'his king' therefore refers to the king of whom person i is a subject. It does not necessarily entail that everybody has a King, but only those who have one serve their respective king. However, according to Definition 6, every value a∈D assigned to the file card i (which represents "one$_i$" in "everyone$_i$", meaning a person) must possess a king in order for the restrictor to be admitted to context C, or, in other words, only when C is defined for the CCP of the restrictor of (28a) can we evaluate its nucleus. This means the presupposition that x_i has a king must be true for every individual in the domain for (28a) to be true. (28a) therefore presupposes that everyone has a king. This runs contrary to Karttunen & Peters (1979) and the empirical survey by Beaver (1994b). Presuppositions triggered in the restrictor of a quantifying expression generally do *not* project to become presuppositions of the quantifying expression as a whole.

Heim goes on to say that for negation, as in (28b), the theory should predict that every nation has a king, rather than just some nations. The CCP for negation found in Definition 5a makes clear that the presuppositions of "not S" are the same as those of S, and that these presuppositions place a restriction on the type of contexts where the CCP of "not S" is defined. With this kind of definition, Heim has committed herself to the reading where every nation in the Domain must be admitted by C- in order for C to be defined for the CCP of (28b)- this means every nation must have a king, so that none of them cherishes its king. For both (28a) and (28b), she mentions the possibility for local accommodation which may cause the presupposition to be canceled; however, it is unclear how exactly this is done in the FCS framework. The same problem exists for indefinites:

(29) a. A fat man was pushing his bike.

b. x_i was a fat man, x_i was pushing x_i's bike.

Heim argues that indefinites are not quantifying, the logical form and the CCP for (29a) therefore do not correspond to those for the universal (or negation). (29a) should be analyzed as (29b):

C + (29b) = (C + x_i was a fat man) + (x_i was pushing x_i's bike)

Due to the fact that "A fat man" is an indefinite, x_i must be introduced as a new variable, and a new file card i is created. For (29) to be true, a context C must first admit that there is a fat man, and then the resulting intermediate context C′ must admit that this man has a bicycle. An unwanted side effect surfaces because the intermediate context C′ must admit "x_i was pushing x_i's bike"- that is every sequence-world pair <g, w> in C′ must map the new variable x_i onto a bike owner in order for the CCP of "x_i was pushing x_i's bike" to be defined for C′, so the admissibility of (29a) in C inevitably entails x_i has a bicycle throughout C. According to Heim's theory, (29) presupposes that every fat man has a bicycle!

That is a very counterintuitive reading for (29b), because what we really want is just one fat man with a bike, not that every fat man has a bike. In response to this, Heim offers a two-step solution: In the event when C does not entail every fat man (in D) has a bike, we first compute C + "x_i was a fat man" = C′. The next clause "x_i was pushing x_i's bike" will not be defined in C′ because not every fat man has a bike. We amend C′ to a temporary C″, which is a set of sequence-world pairs consisting of those <g, w>∈C′ such that g(x_i) has a bicycle in w. C″ is then used to update "x_i was pushing x_i's bike". This way we have a context that admits (29b), but does not entail that every fat men has a bicycle. With this approach, she avoided an unintuitively strong universal presupposition as before, but there is little convincing argument as to why the indefinite should incorporate such a conditional two-step update as part of its lexical properties. Thus the solution seems a little *ad hoc*. Heim mentions that the above solution is a type of global accommodation, stopping short of explaining what exactly that is. A much more comprehensive framework to account for the phenomenon of accommodation is obviously called for.

Anaphoric dependency is handled in FCS via indexation of the file cards. Heim uses file cards to represent discourse referents, where each card is given its own unique number index. When an expression involving a pronoun is uttered, then this pronoun must be given the index of one of the cards in the file, intuitively, the card that will thereby function as its anaphoric antecedent. This turns the CCP of the utterance into a function which maps each context C from its domain onto the subset consisting of those pairs <g, w> for which g(n) satisfies the extra conditions that the new utterance predicates the pronoun. The choice of n can be called the *anaphoric resolution* of the pronoun. Returning to (25c), suppose this sentence is interpreted in the context of $\mathbf{C}_1$, resulting from the utterance of (25a), and there are two cards in the file, one representing a woman, and the other a dog. There are three ways in which the pronoun can be indexed, but only the first one captures the intuitively correct interpretation (as is shown in $\mathbf{C}_3$):

(i) She$_1$ was hurt.

$\mathbf{C}_3$:

File Card 1	File Card 2
1 is a woman	2 is a dog
1 was bitten by 2	2 bit 1
1 was hurt	

(ii) She$_2$ was hurt.
(iii) She$_4$ (or "She$_n$", where n ≠ 1 and n ≠ 2) was hurt.

(ii) is incorrect because 'she' is assigned to be the same as the File Card 2, which denotes the dog. We can obtain the correct assignment for sentences such as (25a) and (25c) by adding the gender feature [male/female/neuter] to each of the NPs on the syntactic representation/logical form. As far as (iii) is concerned, there are no known constraints on indexing which prevent (iii) as logical form. Moreover, it could be that prior to (25c), a context was set up such that a File Card 4 was created to be another woman. Or suppose if another file/context is being considered, where in this file, File Card 4 is a woman. In these cases, (iii) would be felicitous, although ambiguous, because (25a) provides a competing antecedent for the pronoun 'she'.

Heim's explanation is that "what is at work is not a constraint on logical forms considered in isolation, but rather a principle that constrains the choice of logical form *relative to a given file.*" (Heim, 1983a). To rule out (iii) when (25c) is uttered in the background of $\mathbf{C}_1$, Heim gives the "Novelty/Familiarity Condition":

> **Definition 7, Heimian Novelty and Familiarity Appropriateness Condition**
> Let C be a file/context, and S a sentence. S is appropriate with respect to C iff for every noun phrase NP_i with index i that occurs in S:
>
> If NP_i is definite, then there is a File Card i in C s.t. i satisfies the descriptive content of the NP_i.
>
> If NP_i is indefinite, then there is no such File Card i in C.

For the Novelty and Familiarity Appropriateness Condition to be applicable, we must add an additional feature, [± definite], to all NPs on the syntactic representation/logical form. According to Heim, pronouns are similar to definite descriptions in that they both presuppose familiarity, "She_4 was hurt" is inappropriate for $\mathbf{C}_1$ because the index 4 is not found in the file cards under $\mathbf{C}_1$. "Novelty/Familiarity Condition" is only one amongst the many other appropriateness conditions required for anaphoric resolution[23]. Heim (1983a) points out that "much of what has been discussed under the name of presupposition seems to be a matter of conditions of this

[23]Heim assumes several other appropriateness conditions (1982a), for example:

(i) *Every soldier_i is armed. He_j will shoot.

(ii) He_i is armed. He_j will shoot.

(i) appears to be infelicitous, while intuitively, 'he' refers to the same person in (ii). The primary reason why there are no anaphoric relation between the variable/file that is under the scope of a universal quantifier and the pronoun 'he' (which is outside of the scope) is because co-indexing i sort. From the point of view of the task of assigning file change potentials to logical forms, we may take appropriateness conditions as delimiting the range of pairs <C, S> for which the file change operation C+S is at all defined (p. 176)"[24]. In other words, appropriateness conditions are similar to presuppositions in that they determine the set of contexts where the CCP of an incoming sentence is defined. When a sentence S is not appropriate for a context C, that is like when C does not satisfy the presuppositions of S: there is no well defined context change C+S. "Appropriateness conditions" for sentences with anaphora and presupposition triggers should tell us how a context is updated by an incoming sentence containing those triggers, or whether an update is possible at all. This is a very important point, but it raises some pressing questions: What exactly are those appropriateness conditions, and how do they facilitate the context update? To answer these, I turn to Discourse Representation Theory (DRT) (Kamp & Reyle, 1993).

Heim is not the only one who saw a parallel between anaphora and presuppositions. Over the past two decades, a number of linguists and philosophers such as van der Sandt (1989; 1992), Kripke (1990), Geurts (1999), Beaver (2001) and Kamp (2001b) have all noticed the empirical parallel between presuppositions and anaphora, and have modeled their theory according to it. To illustrate

and j is forbidden in such circumstances. An appropriateness condition for pronouns must ensure that contexts where there are no antecedent discourse referents/files other than ones in the universal scope are undefined for the CCP of a pronoun utterance.

[24]There are some further objections to Heim's treatment of anaphoric resolution. Suppose that immediately after the utterance of (28a), the following utterance takes place, according to her example in (Heim, 1983a):

(i) She_1 hit it_2.

Heim simply assumed that the syntactic theory (logical form) has already taken care of the appropriate indexation of these pronouns. However, in a robust semantic theory, nothing of the sort should be taken for granted. What governs pronoun resolution goes far beyond the information that are available in the grammar of a language. Without being unfair to Heim here, I can only imagine that the justifications for her assuming the correct indexation for pronoun resolution lies within the realm of how her appropriateness conditions ought to be defined. Unfortunately, these appropriateness conditions have not been elaborated further as far as I know.

this parallel, we apply the Presupposition Test Battery constructions (also known as Karttunen's filters) that appeared in (9), to some Donkey sentences (Kamp, 1981):

(30) a. If John has kids, then *his* kids are model students in school.
b. It is possible that John has kids, and *his* kids are model students in school.
c. Either John has no kids, or *his* kids are model students in school.

(31) a. If John owns a donkey, he beats *it*.
b. It is possible that John owns a donkey, and he beats *it*.
c. Either John does not have a donkey, or he beats *it*.

The sentences in (30) with the possessive 'his kids' have very similar properties as the sentences in (31) with their occurrences of 'it'. In fact, we get an even more direct parallel when we replace 'his kids' in (30) by the plural pronoun 'they' as in (32). Conversely, the pronouns 'it' in (31) can all be expanded to the possessive NP 'his donkey', thereby turning donkey sentences into cases of presupposition filtering, as in (33):

(32) a. If John has kids, then they are model students in school.
b. It is possible that John has kids, and they are model students in school.
c. Either John has no kids, or they are model students in school.

(33) a. If John owns a donkey, he beats his donkey.
b. It is possible that John owns a donkey, and he beats his donkey.
c. Either John does not have a donkey, or he beats his donkey.

There are numerous such parallels from discourse anaphora to bathroom sentences found in Beaver (2001, p.92) and van der Sandt (1992). In fact, van der Sandt claims that all presuppositions are anaphors. This does not mean presuppositions are treated as anaphors in the strict sense of requiring a textual antecedent. But rather, what van der Sandt meant is that a presupposition trigger is *anaphoric at the level of discourse interpretation*. The resemblance between anaphors and presuppositions obtains even for those items from the list of presuppositions which looked like they were unlikely candidates in the beginning of this chapter; e.g. the propositional complement of a factive verb can be seen as anaphoric to some proposition or fact, represented by a discourse referent/file card, ‘too’ can be seen as anaphorically linked to a discourse referent for some proposition in the salient context, and so on.

As has been discussed earlier, one of the identifying features of presuppositions is that they can project across multiple levels of embedding, while logical entailments do not. Presuppositions are independent from the logical properties of the embedding operators and do not enter into scope relations with them. But there are some exceptions, like those listed in (30): if-then, embedding under modals, either-or. Karttunen (1973) identifies these operators as *filters*. Presuppositions embedded under filters generally do not project, therefore, none of the sentences in (30) presuppose that John has kids. The original motivation for looking at the sentences in (31) was (on the face of it) quite different. One of the primary problems in classical approaches to representing the relationship between an indefinite and a pronoun is that indefinites are interpreted as existential quantifiers, but in donkey sentences, the indefinite must be interpreted by universal quantification:

> Thus the correct first-order representation for (31a), “If John owns a donkey, he beats *it*.”, is as follows:
>
> $\forall$x(Donkey(x) $\wedge$ Owns(John, x) $\rightarrow$ Beats(John, x)), instead of what we get if we assume that indefinites are *always* existentially bound, the ill-formed:
>
> * $\exists$x(Donkey(x) $\wedge$ Owns(John, x)) $\rightarrow$ Beats(John, x).
>
> Or the truth-conditionally incorrect:
>
> * $\exists$x(Donkey(x) $\wedge$ Owns(John, x) $\rightarrow$ Beats(John, x)).
>
> The last formula is incorrect as long as there is something that either fails

> to be a donkey or isn't owned by John. For then the antecedent of the conditional in the scope of the existential quantifier is false and so the formula as a whole (a material conditional) is true when that object is assigned to x, and thus the existential quantifier is true. This formula will under almost any circumstances be true, irrespective of whether John has a donkey or what he does with it. Surely that isn't what (31a) means.

This is unsatisfactory, because clearly a uniform treatment is preferred should it be available, and there are many contexts where indefinites must be translated as existential quantifiers. Both FCS and DRT offer a uniform solution to this, FCS through the use of file cards, and DRT by representing the various entities mentioned in a discourse by means of *discourse referents*. Discourse Referents in DRT represent the semantic contributions made by noun phrases and a variety of other expressions (events, reference times, etc.). In particular, indefinite noun phrases are represented by discourse referents that representation-internally play a role comparable to that of free variables, which enables them to function as antecedents for subsequent anaphoric definites, in particular pronouns. It is only representation externally- that is when the representation is evaluated for its truth condition that these discourse referents often get an existential interpretation, conferred upon them by the truth definition for the representation language. However, some indefinites come out as universally quantified in this setup, among them the indefinite 'a donkey' of (31a)[25]. There are several truth definitions for DRS languages (A DRS language is a formal language, the 'formulas' of which are DRSs). The general definition referred to above can be found in (Kamp, 1981) and for a number of different DRS languages, in (Kamp &

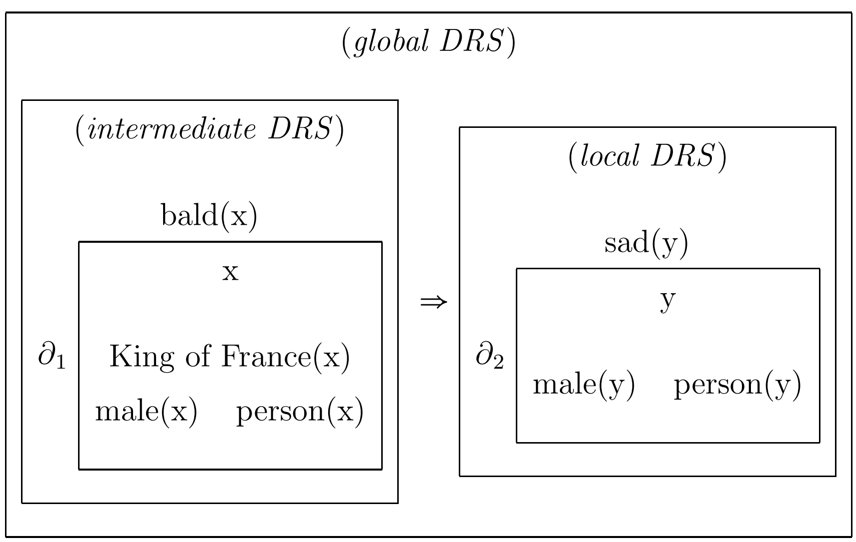
[25]Roughly around the same time, Heim (1982a) also argued for a non-quantificational analysis of indefinites. She points out that indefinites bear non-vacuous co-indexing relations to variables outside of their scope, and therefore they cannot be quantifiers. In addition, what is responsible for the existential force of indefinite statements is the way in which the truth condition of a file is defined. A file is true when there are *at least one satisfying* assignment for it in the context in which it is interpreted. There is therefore no need for a quantificational analysis of an indefinite if existential quantification is already built into the files. I will leave the specific demonstrations out as they are discussed extensively in Heim (1982a).

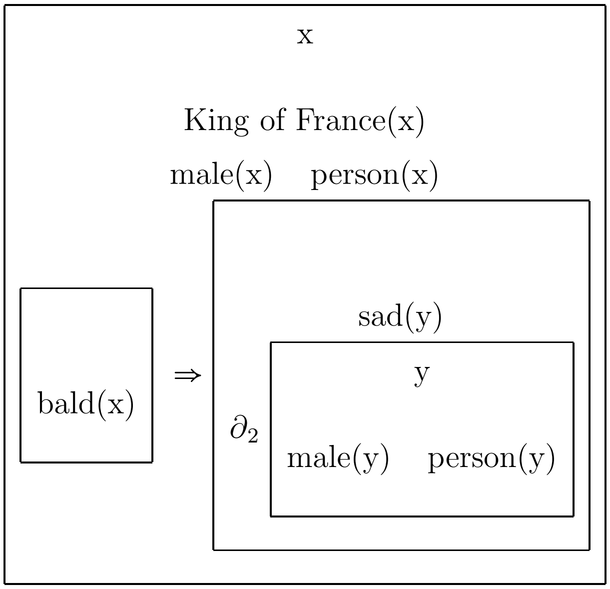
Reyle, 1993). A model theoretic semantics in terms of information state and CCPs, in which DRSs are assigned CCPs in relation to given models, can be found in (van Eijck & Kamp, 1997; van Eijk, 2005). In the original versions of DRT, pronoun resolution was handled via choosing an antecedent for a given pronoun from the set of accessible discourse referents from the DRS that has been constructed so far. In the approach of van der Sandt (1992), pronouns are treated as presupposition triggers, which give rise to presuppositions that must be 'bound' in the discourse DRS that acts as discourse context. In this approach, pronouns are treated on a par with definite descriptions. This give rise to presuppositions (as they have been assumed to do from Karttunen (1993) onwards), but they too are subject to the special kind of presupposition binding that the DRT framework makes it possible to state in precise terms.

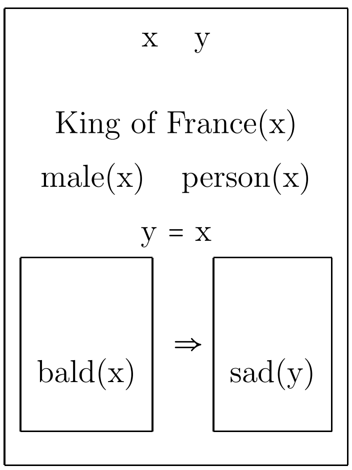
According to van der Sandt (1992), presuppositional binding works in this approach in exactly the same way as anaphoric pronoun resolution in standard DRT. To illustrate, consider the following:

(34) a. If *the King* of France is bald, then *he* is sad.

b.



c. 

d. 

(34b)-(34d) are step-by-step snapshots of how the pronoun ('he') and the presupposition ('the King of France') in (34a) are introduced into the same structure and thus resolved in the context of utterance. There are three different layers, or scopes, involved in the DRS of conditional (and universally quantified) sentences, such as the one shown in (34b). The outermost box is called the *global DRS*. The left hand side, antecedent sub-DRS of the conditional, is regarded as the *intermediate DRS*, and the right hand side sub-DRS, those within the scope of the consequent is under the *local DRS* (these scopes are labeled in brackets in (34b)). (34b) is the *Preliminary DRS* after the sentences in (34a) enter the initial context (which we assume for the sake of illustration to be empty). (34b) is 'preliminary' because it contains two unresolved presuppositions. The first one, marked by ∂_1, is attributed to the definite description and presupposition 'the King of France'. The second one is obtained from the anaphoric pronoun 'he', and is marked by ∂_2. Anaphoric pronouns are pronouns which refer back to individuals that have been introduced previously in the discourse. They are among the most familiar examples of context dependence. The difference between the approach used in (34b), and the way in which anaphoric pronouns are generally treated in standard DRT (Kamp & Reyle, 1993) is merely superficial: In standard DRT, the construction rule for pronouns introduces a new discourse referent in the scope in which the pronoun is uttered. In this case, the referent is brought into the local DRS. Conditions attached to the pronoun, such as gender, human or not human, etc, are also introduced at this point. In standard DRT, the referent representing the pronoun is immediately identified with a *suitable* discourse referent chosen from the universe of the DRS during its construction from a syntactic parse of the given sentence. In a later expansion of the DRT framework (Kamp et al., 2008), anaphoric pronouns are treated as carrying presuppositions of a special kind, viz. that a *suitable* antecedent must be available for them in the context of interpretation during presupposition resolution. In this latter version, anaphoric elements are encoded separately (as in the DRS marked by ∂), and they are resolved only after the (Preliminary) DRS for the incoming sentence has been fully constructed. The notion of suitability depends on many considerations, both linguistic and non-linguistic. Most studies on anaphora in the fields of computational linguistics and Artificial Intelligence have focused on the refinement of conditions that qualify an antecedent as 'suitable' for a pronominal anaphor (e.g. Bullwinkle, 1977; Sidner, 1979). A good deal of the work done in DRT with regard to presuppositions is also devoted to articulating what those suitability conditions might be. Some of the most basic ones that come to mind are the meaning postulates attached to the masculine pronoun that was mentioned earlier. More will obviously have to be said about this topic in the chapters to come.

The transition from (34b) to (34c) is a variety of presupposition resolution known as *presupposition accommodation*. Accommodation, loosely speaking, occurs when an utterance contains certain presuppositions that impose conditions on the context. If these conditions are not fulfilled by what the hearer takes to be the context, then the hearer will be inclined to infer them and adjust the context so as to make the utterance felicitous. Van der Sandt regards accommodation as a kind of *context repair strategy*, a way of making sense of an utterance that involves presuppositions which are not satisfied by the initial context. Accommodation is therefore a mechanism that inserts the required conditions into the context of utterance/the DRS representing such a context. The scopes in which accommodation can take place are either global, intermediate, or local. In the case of (34c), *global accommodation* is the most preferred amongst the three. As a result of accommodating ∂_1 globally, (34c) is a DRS that states: "there is a King of France, and if this King of France is bald then he is sad". Meaning postulates which are part and parcel of our world knowledge about the King of France, such as the fact that a King must be male and must be a person, may also be introduced at the point of accommodation[26].

The resolution of the presupposition triggered by the anaphoric pronoun is captured by the transition from (34c) to (34d). The information in the DRS marked by ∂_2 is merged into the global DRS. By means of the condition "y = x", 'he' is identified with 'the King of France'. This identification is justified because the conditions introduced by the meaning postulates of the two NP's match perfectly. (34c) to (34d) is an instance of binding, where the discourse referent introduced by the pronoun binds with the antecedent that was introduced by presupposition accommodation earlier.

Even though similarities between anaphoric pronouns and presuppositions are ostensible, there remain some marked differences. Pronouns must always have an antecedent, and if there is no matching antecedent, the utterance involving the pronoun is infelicitous. Presuppositions- as traditionally identified in the literature (e.g. Karttunen, 1973)- although they can be resolved by binding to an antecedent, do not always bind. They also have the capacity to accommodate, and, as mentioned earlier, accommodation is an update of the context which results in the presuppositional

[26]However, as the theory gets more complex, general knowledge and encyclopedic knowledge become a category of context in their own right. For now, we simply assume that they enter the context as part of the accommodation procedure with the definite description.

expression being entailed by the updated context. In Germanic languages such as English and German, pronouns generally have no more descriptive content than their gender (and that the individual is a person or an object). Presuppositions on the other hand, often have far richer descriptive content than pronouns. These descriptive contents can be used to facilitate the binding process by identifying the conditions of the semantic content to the most suitable antecedent available. The most "suitable" antecedent is the one with the largest number of matching discourse conditions. Presuppositional expressions differ from pronouns also in that they tend to have more structural complexity, and that they can embed other presuppositions or anaphors, as in sentences like: "John knows that the thief lost his watch in the backyard".

There are two important features in van der Sandt's approach which are unprecedented and give a handle on solutions to problems that Heim, Stalnaker, and others left unsolved. First, van der Sandt takes advantage of an inherent structural property of DRSs: The structural relation between the position in which a presupposition trigger is represented in a Discourse Representation Structure, and the position in which its antecedent is represented. The antecedent must be located somewhere along the *anaphoric accessibility path* from the representation of the trigger[27]. Accessibility is a necessary (but not sufficient) condition for presuppositional binding. An antecedent must always be accessible to an anaphor in order to be a potential candidate of presupposition resolution. In essence, accessibility is an antisymmetric binary relation between a discourse condition and a discourse referent under two different scopes, or two DRSs, where one is recursively subordinate to another:

Definition 8, DRT Accessibility Relation

Let K be a DRS, U_K the discourse universe of K, x a discourse referent, and γ a DRS condition.

[27]Often in the context of presupposition accommodation, 'anaphoric accessibility path' can be used interchangeably with 'projection line'. A DRS K_j is lower on the projection line than K_i just in case K_i subordinates K_j, or in other words, if K_i is accessible from within K_j.

$<$ is the subordination relation. $K_1 < K_2$ reads "K_1 is subordinate to K_2". If $K_1 < K_2$ then one of the following is the case:

1. K_1 is immediately subordinate to K_2 iff γ_{K2} contains either K_1, $\neg K_1$, $K_1 \wedge K_3$, $K_1 \vee K_3$, $K_1 \rightarrow K_3$, or $K_1 \diamond K_3$. K_3 is a DRS, $\rightarrow$ is the conditional operator, and $\diamond$ is the universal duplex condition.

2. K_1 is immediately subordinate to K_2 iff $K_2 \rightarrow K_1$, or $K_2 \diamond K_1$.

3. There is a DRS K_3 s.t. K_3 is subordinate to K_2 and K_1 is immediately subordinate to K_3.

x is accessible from y, $x \succ y$, in K, iff:

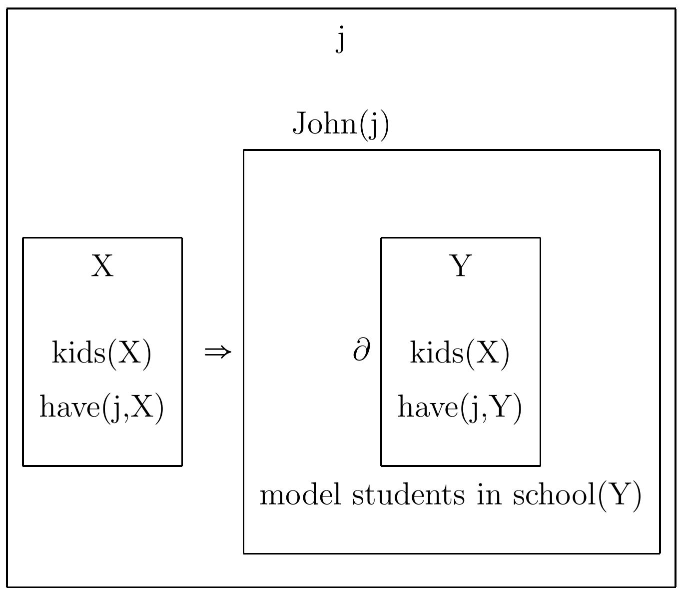
1. x and y are both in U_K.

2. There are $K_1 < K$ and $K_2 < K_1$ such that x belongs to U_{K1} and y belongs to U_{K_2}.

So given a conditional sentence (34a), when we try to bind the anaphoric pronoun represented by y at the stage of (34d), since the local DRS is subordinated by the global DRS, x is accessible from y ($x \succ y$), and therefore becomes a potential candidate for presuppositional binding.

Van der Sandt (1992) argues that not only the same mechanisms should be applied to both pronoun resolution and presupposition projection, he goes further by concluding that under this view, presuppositions are not really canceled (Gazdar, 1979), suspended (Horn, 1969), or filtered (Karttunen, 1973), instead they are *bound to a previously established antecedent* just like the pronouns. The filtering of the possessive presupposition in (30a), for example, should really look like this:

Presupposition triggered in the consequent position of the conditional, prior to binding is as follows:



In DRT, since the antecedent of a conditional is accessible from the consequent position, the presupposition, marked by ∂, has an antecedent. In van der Sandt's terms, the presupposition Y is identified to X in the antecedent. The DRS marked by ∂ no longer plays a role in the DRT construction, and therefore is discarded after resolving with its antecedent. We are left with the following DRS:

j

John(j)

X Y kids(X) have(j,X) X = Y	$\Rightarrow$	model students in school(Y)

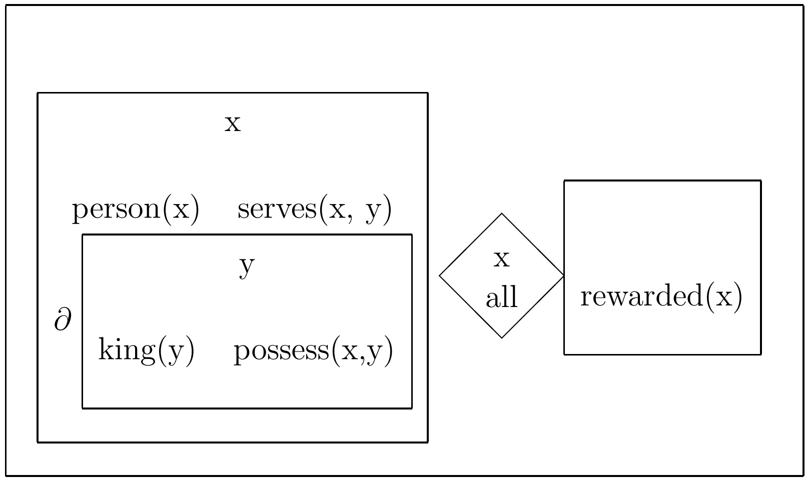
From the present perspective, Karttunen's plugs are constructions that require the presuppositions generated within that scope, if they are not bound within their scope, be accommodated within it (local accommodation). And Karttunen's holes are constructions that do not allow for accommodations within their immediate scope if a presupposition generated within their scope is not justified (i.e. bound or accommodated at some subordinate scope level), justification must take place at a higher scope level). In addition, Since information accommodated in the global scope becomes part of the contextual resource available to all anaphora throughout the discourse, global accommodation has often been identified with what is traditionally termed projection (Langendoen & Savin, 1971; Karttunen, 1973).

The problem Heim faced with universal constructions where a presupposition trigger occurs in the restrictor scope is solved elegantly using van der Sandt's approach. Recall (28a):

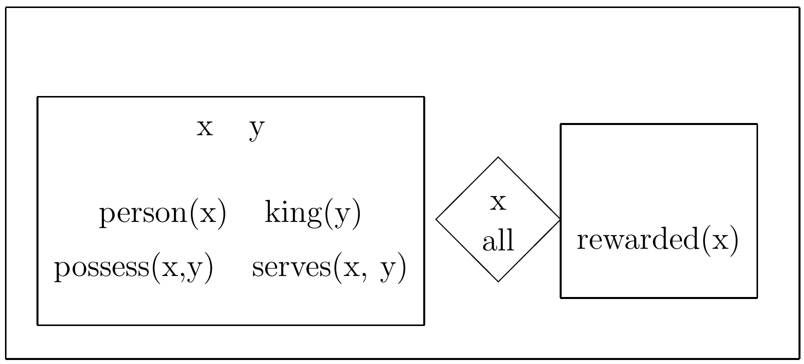
(28a) Everyone who serves his king will be rewarded.

Using Heim's CCP, we are left with the reading that everybody must have a king. The desired reading, however, is that everyone who has a king and serves his king will be rewarded. This is represented in (35b):

(35) a.



b.



The transition from (35a) to (35b) is called *intermediate accommodation* because the insertion of the presuppositional information (marked by ∂) takes place in the intermediate, restrictor scope of the universal quantifier. The inaccurate prediction made by Heim's account is that (28a) requires global accommodation. Thankfully, the structural relation that is made available in DRT allows us the option to avoid this by accommodating intermediately or locally. A pertinent question emerges at this point: Just how exactly do we decide in which scope accommodation should take place? This brings us to the second feature of van der Sandt's theory which I see as having far-reaching consequences for the theory of presuppositions.

This other important feature in van der Sandt's anaphoric treatment of presupposition is the availability of a formal apparatus which we may use to spell out precisely how binding and accommodation should be performed on different, given contexts. What distinguishes van der Sandt's theory from all previous approaches introduced in this chapter is the special dynamics in which binding and accommodation (often referred together as either *presupposition justification* or *presupposition resolution*) offer to semantic constructions. Presupposition resolution is a stage of semantic construction but does not rely on any syntactic information and therefore is not thought of in compositional terms. It is a separate, and additional computational process, distinct from the syntax-semantic interface that is commonly assumed in Standard DRT.

As was shown earlier, the structural relation between the DRSs of a representation gives us at least three scope options in which binding and accommodation can take place: global, intermediate, and local. The pertinent question was raised not too long ago, "how do we decide at which scope to perform presupposition resolution", is essentially the same as asking: "what kind of updated context is the most suitable one when the hearer of an utterance admits a presupposition?" This analogy was keenly observed in Beaver (2001, p. 102), and parallels are drawn between CCP's version of accommodation (Heim, 1983b, p. 401/p. 5) and the account DRT offers for it. For example, according to Definition 5a, a context update for "if A then B" is two-step, the context C is first updated by ϕ_A, then by ϕ_B. Each of those two stages in Karttunen's terms involve local contexts, the first conjunct A is admitted in the local context C, $C \triangleright A$. Then the updated context C+A admits B, $C \cup A \triangleright B$ (refer to Definition 2). Neither Karttunen nor Heim discussed in any detail what should happen when *some presuppositions are not admitted*, even though both acknowledge that communication often continue even when presuppositions aren't satisfied, because "the listener is entitled and expected to extend it (the context) as required. He must determine for himself what context he is supposed to be in on the basis of what was said and, if he is willing to go along with it, make the same tacit extension that his interlocutor appears to have made" (Karttunen, 1974, p. 412).

The way in which listeners may be able to 'extend' the context is precisely by using van der Sandt's accommodation mechanism. Given an utterance "if A then B", let ψ be a presupposition triggered in the scope of the consequent B, and suppose ψ is unsatisfied in the local context C+A (i.e. $C \cup A \not\triangleright B$), the equivalent of global accommodation in CCP involves inserting ψ into the initial context, that is, by performing the following CCP operation:

$$C \cap \psi \setminus ((C \cap \psi \cap \phi_A \setminus (C \cap \psi \cap \phi_A \cap \phi_B))$$

The equivalent of local accommodation in CCP would be to simply insert ψ into the local context in which the consequent of the conditional (B) is evaluated:

$$C \setminus ((C \cap \phi_A \setminus (C \cap \psi \cap \phi_A \cap \phi_B))$$

And intermediate accommodation where ψ is inserted into the intermediate context in which the antecedent A is being evaluated:

$$C \setminus ((C \cap \psi \cap \phi_A \setminus (C \cap \psi \cap \phi_A \cap \phi_B))$$

Recall that Heim describes her solution to (29) a case of *global accommodation*, this is made transparent with the following DRSs:

(29a) A fat man was pushing his bike.

(36) a.
$$\begin{array}{|c|}\hline \text{x} \\ \\ \text{fat man(x)} \\ \text{male(x)} \quad \text{person(x)} \\ \partial \begin{array}{|c|}\hline \text{y} \quad \text{z} \\ \\ \text{male(y)} \quad \text{person(y)} \\ \text{bike(z)} \quad \text{possess(y, z)} \\ \hline \end{array} \\ \hline \end{array}$$

b.
$$\begin{array}{|c|}\hline \text{x} \quad \text{y} \quad \text{z} \\ \\ \text{fat man(x)} \\ \text{male(x)} \quad \text{person(x)} \\ \text{bike(z)} \quad \text{possess(y, z)} \\ \text{x = y} \\ \hline \end{array}$$

Curiously, the transition from (36a) to (36b) does not appear to fit in van der Sandt's category for accommodation, it is in fact, a case of binding in DRT. To refresh our memory, Heim's proposal for the utterance in (29a) was to first update the context with "x_i was a fat man", resulting in an intermediate context C′. C′ is the set of sequence-world pairs <g, w> where g assigns some variable x to some fat man in w. C′ is truth conditionally equivalent to (36a) *without* the sub-DRS marked by ∂. In order to prevent the reading that "every fat man has a bicycle", Heim uses indexation to *fix* the fat man to a specific file card x_i. What she really meant by *global accommodation* is that the CCP of the clause 'was pushing his bike' is only defined for those contexts C (sets of sequence-world pairs) which satisfy the presupposition- more precisely, the CCP is defined for C, given an index of the file card for the indefinite NP 'a fat man', if and only if for all <g, w>$\in C$, g(x) has a bicycle in w. An interpreter of (29a) who takes the context of interpretation to be C, where C does contain pairs <g, w> such that g(x) does not have a bicycle in w may try to accommodate, either by assuming some different context C′, which does admit the

CCP for 'was pushing his bicycle'. One way such a C′ can be obtained is by restricting C to the subset of the pairs <g, w> such that g(x) does have a bicycle in w. But this is not necessarily the only way of accommodating to a new C′. In DRT, this approach is essentially the same as identifying x with the discourse referent y which represents the male pronoun. To put thing another way, the information that y is a male person and owns a bike can be said to have been inserted into the global context before the condition "x=y" is introduced, and this insertion can be regarded as a kind of global accommodation. However, as soon as we fix y to x by introducing the condition "x=y", the presupposition resolution process is finalized through binding. CCP does not make any distinction between these rather subtle differences.

Just how do we decide which of the three scopes to perform presupposition resolution? Without further ado, van der Sandt's answer to it is by listing a set of *General Resolution Constraints* and *Preference Orders* in which all presupposition resolution must follow. Every existing contemporary study on presupposition lists these constraints declaratively, as we find in Definition 9a. The constraints listed here are discussed and articulated in much greater detail in (Beaver, 2001; Beaver and Zeevat, 2006; Blackburn et al., 1999; Blackburn and Bos, 1999), they will also be given a much closer look when we get to Definition 9b:

Definition 9a, Van der Sandtian Resolution Constraints and Preferences (Declarative Presentation)

> When dealing with presupposition resolution (both binding and accommodation), van der Sandt relies on the following *General Resolution Constraints*:
>
> 1. A presupposition cannot find its antecedent in a DRS that is not accessible to the position it is triggered.
>
> 2. Before a presupposition can be resolved, it must not have a presupposition of its own.

3. *Trapping* (Beaver 2001; Beaver and Zeevat 2006): There must not be a free variable occurrence as a result of presupposition resolution.

4. *Informativity Constraint*: The DRS resulting from presupposition resolution must be more informative than before the resolution. This means *the non-presuppositional DRS before the resolution* must not entail *the final DRS that is produced after the resolution*.

5. A special case of the Informativity Constraint is when after presupposition resolution (typically accommodation), some subordinate DRS is entailed by the DRSs which are superordinate to it. This is not allowed. An example of this would be the global accommodation for the sentence: "If John has children, his children will be spoiled".

6. *Consistency Constraint*: The DRS resulting from presupposition resolution must be consistent. This means no logically contradicting conditions throughout the resulting DRS.

7. A special case of the Consistency Constraint is when after presupposition resolution (typically accommodation), the negation of some subordinate DRS is entailed by the DRSs which are superordinate to it. This is not allowed. An example of this would be the global accommodation for the sentence: "If there is no King of France, the King of France is not bald".

Operating under the above constraints, van der Sandt's *General Resolution Preference Order* is as follows:

1. Binding to a *suitable* antecedent is preferred over accommodation.

2. Binding is preferred to take place as close (on the accessibility path) to the source DRS where the presupposition is triggered as possible.

3. Accommodation is preferred to take place as global as possible.

These constraints and preferences constitute an integral part of *binding conditions* in general. Binding conditions are rules associated with a given discourse referent and determine the quantificational or referential role this variable is to play in the semantic representation where it is introduced. We assume that all NPs introduce variable and that these variables can be bound in three different ways- quantificational (for quantifying NPs), structural (for indefinite NPs), and presuppositional (for presupposition triggers). Quantificational and structual binding are part of constructing the Preliminary DRS for the given sentence and are of no concern here (their constructions are already described in detail in e.g. Kamp & Reyle, 1993). The variables introduced by definite NPs occur as part of the referential presupposition that these NPs give rise to the Preliminary DRS. In the transition from the Preliminary DRS to the final DRS (which can then be merged with the context DRS), all presuppositions- the referential presuppositions from definite NPs, like all others, need to be resolved. For a referential presupposition, this means that a referent has to be determined for its discourse referent. According to van der Sandt, resolution can either take the form of binding or accommodation. In general, a presupposition gets 'bound' (in a sense introduced now) when going from preliminary to the final DRS, if the information needed for its resolution can be found higher up in the sentence itself (local or intermediate binding, or in the discourse context/global binding). When the presupposition is referential, then binding means finding a discourse referent (in sentence DRS or context DRS) that can be used for its antecedent, using it as contextual means that the discourse referent from the presupposition is identified with it. Accommodation of a referential presupposition amounts to making up a referent, by introducing one into the relevant DRS universe and then identifying the discourse referent from the presupposition with it.

In addition to the declarative definition presented in 9a, I would like to use another approach and define those resolution constraints in a procedural, algorithmic manner that is similar to object-oriented programming codes (e.g. C, C++, and Java). The reason I favor this pseudo-code style definition will become clear in Chapter 3. We only need to bear in mind for now that essentially, my presentation of these resolution conditions in 9b is exactly the same as that of van der Sandt's in 9a:

Definition 9b, Van der Sandtian Resolution Constraints and Preferences (Procedural Presentation)

> The following program (which I will refer to later in this chapter as *the primary function*) is executed in the scope of a sub-DRS Q to which the presupposition trigger we are trying to resolve is adjoined (Q is the starting point of the program execution. K is the *current DRS*. Initially, Q = K):

> (primary function)
>
> **If** there is a DRS K′ s.t. $K' < Q$, and K′ contains another presupposition
>
> > **Then** <*Abort*>
> >
> > **Else** (continue)
> >
> > **While** the current presupposition remains unresolved and we are not at the global DRS
> >
> > > Move up one level on the accessibility path
> > >
> > > **If** there is a *Suitable Antecedent*
> > >
> > > > **Then** *Bind* with that antecedent; <*Done*>

Else (continue)

(We arrived at the global DRS)

While the current presupposition remains unresolved and we are not back in Q (the original position where we started)

Move down one level on the accessibility path

Accommodate$_i$ in the current DRS

If there is *Inconsistency* or *Redundancy* or a *Free Variable*

Then *Undo* the previous accommodation (*Accommodate*$_i$); (continue)

Else <*Done*>

<*Abort*>

There are three types of sub-functions embedded in the above primary function, I will describe them declaratively instead of defining them with pseudo-code until when this becomes necessary:

Type 1. Functions which are completely unrelated to the resolution constraints and preferences that we are concerned about. These functions merely serve to indicate how our heuristic/program should execute at certain points of the code. These functions are marked by ‘< >’:

<Abort>: This indicates that something has gone wrong, and the presupposition resolution function that is currently being executed cannot continue any further. The current function is aborted and the program control is passed onto another function (some other semantic construction programs which do not concern us here).

<Done>: We have successfully resolved the current presupposition. Exit the function and move on to the next presupposition.

Type 2. These functions will return a value. The possible values include either a truth value {false, true}, or in the case of *Suitable Antecedent*, a link/pointer to the discourse referent of the suitable antecedent we are looking for:

Suitable Antecedent: Seeks out in K, the current DRS, a discourse referent that has all the conditions to match those of the presuppositional anaphor. If this referent is found, return a pointer to it.

Inconsistency: Return the value 'true' if there is a DRS K' s.t. $K' < K$, and K' is inconsistent. K' is inconsistent iff $\forall$M, f (M, f $\models$ K $\leftrightarrow$ M, f $\models$ $K[K'_{\perp}]$, where $K[K'_{\perp}]$ is a DRS like K except that K' is replaced by an inconsistent DRS with the same universe as K' but inconsistent conditions. Otherwise return the value 'false'.

Redundancy: Return the value 'true' if there is a DRS K' s.t. $K' < K$, and K' is redundant. K' is redundant iff $\forall$M, f (M, f $\models$ K $\leftrightarrow$ M, f $\models$ $K[K'_{\top}]$, where $K[K'_{\top}]$ is a DRS like K except that K' is replaced by a DRS with the same universe as K' but no discourse conditions. Otherwise return the value 'false'.

Free Variable: Return the value 'true' if there is a discourse referent u s.t. $\gamma(u)$ is a condition in the current DRS, K, $u \notin U_K$, and for all $K' < K$, $u \notin U_{K'}$. Otherwise return the value 'false'.

Type 3. These are functions which will make direct modification on contents under the scope of the sub-DRS in which the function is currently being executed. These functions are the resolution operations that was proposed by van der Sandt (1992):

Bind: Insert the condition $u = v$ into K, where u is a variable that represents the presuppositional anaphor, and v is the suitable antecedent found via the *Suitable Antecedent* function.

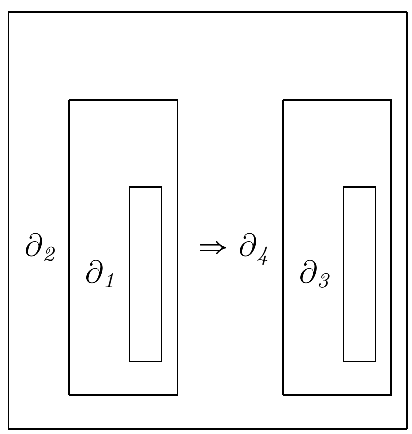
Accommodate: Insert the discourse referent of the presuppositional anaphor into U_K, and insert all the conditions in the presuppositional DRS into that of K.

Undo: This simply returns K to a state that is immediately prior to the execution of the function specified under its argument parameter (e.g., Bind, Accommodate).

Every declarative statement written in the (primary) function in 9b can be converted into pseudo-code and executed procedurally. This not only includes the sub-functions embedded by the primary function, such as *Inconsistency*, *Redundancy*, *Accommodate*, etc. but also conditions required by the If-Else and While operators. However, I will only apply the pseudo-code approach when the focus of our investigation calls for it.

To ensure the general resolution constraints specified in Definition 9a are applied to all presuppositions across the board, it is necessary to assume that the primary function in 9b is embedded in *every* presuppositional DRS. The operations specified in the primary function are responsible for resolving the specific presupposition that it is embedded with. The first If-Else statement in the primary function states that if there is a sub-DRS in the scope of the current DRS and the sub-DRS contains a presupposition, then the execution of the primary function aborts. This is a measure to prevent resolution of presuppositions that have further embedded presuppositions in their scope (General Resolution Constraint 2 in 9a). The most efficient way to prevent this type of abortion, of course, is to start presupposition resolution by executing the primary function of the innermost presupposition, and work our way out from there. I take it for granted for the meanwhile that the main semantic construction algorithm will take care of this. The first If-Else statement is therefore a fail-safe mechanism to ensure nothing goes wrong.

When there are multiple presuppositions under the same clause, there are two different dynamics involved in terms of the order in which the primary function of different presuppositions are executed. The first dynamic is when presuppositions are nested- one embedded under the other. This is handled by the first If-Else statement of the primary function, as explained in the last paragraph. The second dynamic is when presuppositions are not nested, but instead, along the same projection line, or accessibility path, take for example the relation between presupposition ∂_4 and ∂_2 in the following DRS:



The algorithm in 9b is non-deterministic in the sense that it has nothing to say about the order in which the primary functions of those presuppositions are performed. Even though we know ∂_1 must come before ∂_2 and ∂_3 before ∂_4- we cannot decide whether ∂_2 should come before ∂_4 or vice versa. There is a very strong tendency for us to believe that ∂_1 must be resolved first, followed by ∂_2, then ∂_3 and ∂_4. This is because the presuppositions in the antecedent of a conditional (or quantifying) expression often serve as antecedents for the presuppositions that follow, for example, "if John likes his dog, he will spoil the dog", the definite in the consequent 'the dog' is to be identified to the referent representing 'his dog', this means 'his dog' must be resolved first. This generalization however, is not fool-proof, counter-examples can be easily found in cataphora, e.g. "if John spoils the dog, he must really like his dog Snoopy". Here, it seems that we should resolve 'his dog Snoopy' from the consequent scope first, if we intend the reading of this sentence to be referring to the same dog. Van der Sandt's theory obviously have nothing to say about this issue, but it is a contentious one, and only through the algorithmic approach presented in 9b that we are confronted with it. In the meantime we will leave this question open.

Coming back to 9b, the main clause of the primary function in 9b is divided into two parts, marked by the While operator. The first part deals with presupposition binding, the second with accommodation. The order in which these two parts are arranged guarantees that binding takes precedence over accommodation (General Resolution Preference Order 1 in 9a). The first While-loop moves up on the accessibility path and looks for a suitable binding antecedent. If no suitable antecedent is found and the program execution reaches the global DRS, the second While-loop comes into play. The program execution will move downwards on the accessibility path in an attempt to accommodate the presupposition. The upward then downward movement of the function is in accordance with the General Resolution Preference Order 2 and 3 in Definition 9a. The way in which accommodation works is slightly different in the procedural definition. According to 9b, we first accommodate, and then check for free variables (trapping), inconsistency and redundancy (non-informativity) (General Resolution Constraints 3-7). If any of those constraints are violated, the Undo sub-function will roll back the DRS to the state it was in just before accommodation was attempted. The While-loop will then move us further down the accessibility path and try to accommodate again. This process continues until either we have succeeded in accommodating without violating any of the constraints, or when we have returned to the point where we first started (the sub-DRS of the presupposition we are trying to resolve). In the latter case, since we have run in vain through every scope of the Preliminary DRS in an attempt to bind or accommodate, we reach the conclusion that there simply is no way to resolve our current presupposition, and the program aborts. Definition 9b captures all of the resolution constraints and preferences that are specified in 9a. The two definitions are functionally equivalent of each other.

The algorithmic take on presupposition resolution presented in Definition 9b is a much more powerful way of describing the conditions and procedures involved in presupposition resolution for the following reasons: It clearly demarcates the tasks involved in presupposition resolution, allowing us to zoom-in on each of the sub-tasks and to pin down what exactly needs to be done to accomplish those sub-tasks. Take the *Suitable Antecedent* function for example. The task of identifying a suitable antecedent for the given presuppositional anaphor is encapsulated in its own functional declaration, and we are cornered in a position where we must clarify exactly what we meant by 'suitability' instead of the hand waving we have allowed ourselves before. Furthermore, a detailed, step-by-step construction algorithm ought to be specified for *Binding* and *Accommodation*. The conditional operator If-Else is an integral tool for defining resolution algorithms, because it allows for different sub-tasks to be performed in different scopes of DRSs and under different context situations. To a certain extent, I suspect the traditional presentation (9a) is responsible for the entrapped perspective that resulted in many of the limitations in the current developments on presupposition resolution. The algorithmic perspective (9b) on the other hand, highlights many previously unaddressed questions which take us well beyond van der Sandt and any other accounts of presupposition known to me.

As our chronicle on presuppositions draws to its end, perhaps it is worthwhile to pause and recognize that van der Sandt's DRT-based model is by far the most successful attempt to account for the presupposition phenomenon. It describes and predicts a wide range of empirical data that encompasses almost all of his predecessors- from Karttunen's plugs, holes, filters, context satisfaction and Stalnaker's context update, to Heim's CCP. Although I have not recounted in any detail Gazdar's cancelation theory (Gazdar, 1979a; 1979b), the preference for global over local accommodation in van der Sandt's account in fact, indirectly mimics the preference for projection over cancelation in Gazadar's. By applying the resolution constraints outlined in Definition 9a, van der Sandt handles cases of explicit presupposition denial and other types of cancelation (e.g. when a presupposition is out-competed by implicatures) just as well (Beaver, 2001, p. 110 has a full summary of van der Sandt's accomplishments). The utilization of the DRS structural properties and the specification of resolution constraints constitute a major breakthrough that helps address issues previously unsolved, issues such as the correct indexation in anaphoric resolution, and the problem of presupposition accommodation. Furthermore, accommodation makes discourse referents in embedded positions available for anaphora that could not access them otherwise. This is significant because it justifies the stipulation in DRT that the discourse referent of a definite description or a proper name should be by default promoted to the global DRS regardless of how deeply embedded its expression is within the overall sentence[28]. Take for example:

(37) a. John does not believe that he saw the tallest mountain. But it was right in front of him.

[28] Definite descriptions differ from proper names, however, in that they not only accommodate, but they can also be used anaphorically to refer to an individual established by prior discourse. This will become transparent in Chapter 3.

b. $$\boxed{\begin{array}{c} \text{j} \\ \\ \text{John(j)} \\ \neg \boxed{\begin{array}{c} \text{believe(j,} \boxed{\begin{array}{c} \partial_1 \boxed{\begin{array}{c} \text{x} \\ \\ \text{tallest mountain(x)} \end{array}} \\ \text{saw(j,x)} \end{array}} \text{)} \end{array}} \\ \\ \partial_2 \boxed{\begin{array}{c} \text{y} \\ \\ \text{in-front-of(j,y)} \end{array}} \end{array}}$$

c. $$\boxed{\begin{array}{c} \text{j} \quad \text{x} \\ \\ \text{John(j)} \quad \text{tallest mountain(x)} \\ \neg \boxed{\begin{array}{c} \text{believe(j,} \boxed{\begin{array}{c} \\ \\ \text{saw(j,x)} \end{array}} \text{)} \end{array}} \\ \\ \partial_2 \boxed{\begin{array}{c} \text{y} \\ \\ \text{in-front-of(j,y)} \end{array}} \end{array}}$$

d.

j x y
John(j) tallest mountain(x) in-front-of(j,y) x = y $\neg$ $\boxed{\text{believe(j, } \boxed{\text{saw(j,x)}} \text{)}}$

(37b) is the Preliminary DRS for (37a). Not only is the discourse referent for the definite 'the tallest mountain' embedded in the intentional context of 'believe'- a position that is inaccessible to the pronominal anaphor- the problem is further compounded by the fact that the antecedent also falls under the scope of negation. Van der Sandt's theory predicts global accommodation for the definite presupposition, as shown in (37c). This elegantly enables the pronoun 'it' to bind with 'the tallest mountain', as in (37d). It is fairly uncontroversial to assume that proper names and definite descriptions are presuppositions (see e.g. Heim, 1983a; Kamp, et al., 2008; Roberts, 2003, etc.), and should be treated as such. For this reason, proper names and definites are accessible to pronominal anaphora and binding should be possible regardless of their embedding positions. This is exactly the way it should be.

Van der Sandt's theory however, is not entirely without flaws. Many semanticists who followed his path for instance, have revealed a considerable level of complexity in presupposition resolution (Kamp, 2001a; 2001b; Beaver, 2002; Beaver/Zeevat, 2006). Chapter 2 will outline some of the most pressing challenges van der Sandt's theory currently faces. The perspective demonstrated in Definition 9b opens up some new grounds but only gives us a flavor as to where we might be heading. It is from there that I argue for a more reductionist, lexically based approach to presupposition resolution, and how such an approach is instrumental in tackling some of the present challenges. In Chapter 3 and 4, I will present two case studies of presupposition triggers, first the definite determiner, then superlatives and ordinal number expressions. I will analyze these from a lexical standpoint, and demonstrate some of the advantages and insights that can be gained from this new, more algorithmic vintage point.

Chapter 2

Presupposition in DRT, Present and Future

A recurring question towards the end of the last chapter: "How do we decide at which scope to perform presupposition resolution?" can be seen as part of the broader question: "What kind of context update strategy is most suitable when the hearer of an utterance accepts its presuppositions?" Van der Sandt did provide a list of constraints and preferences to try and address that question (in Definition 9a), but they do not appear to be sufficient.

Presented in this chapter are mainly two types of problems in van der Sandt's resolution constraints. On the one hand, van der Sandt's exploitation of DRT's inherent structural properties turns out to be both its strength and its weakness. Purely structural approaches like his can do very little beyond manipulating a certain given information within different logical scope relations, but they do not inject new information- of the sorts presuppositions tend to do. The story here is about *what will be accommodated* - usually (and perhaps always) globally- and that story depends on various aspects of world knowledge and knowledge about word meaning. One of the important morals here is that what is accommodated is not necessarily the presupposition itself but some assumptions which are natural given all the interpreter knows in the situation in which the utterance in question is made and from which the presupposition can be seen to follow.

On the other hand, there are objections against certain technicalities within van der Sandt's theory and the way in which it is formalized. Here, one has the feeling that an improvement can be made by a refinement of the structural conditions, or certain suspensions/adjustments of the existing resolutions, preferences and constraints. In these cases the question is not what principles guide the accommodations the interpreters make so that a given presupposition can be seen to follow from them. It is not about accommodation, but about getting information that is overtly present in the sentence into a position where it can bind to a given presupposition in a way that is consistent with van der Sandt's general constraints. It is not always possible to separate these two aspects of presupposition resolution cleanly, quite apart from the fact that there are some cases of resolution where both considerations play a role. But in principle, these are quite different issues. I will make clear from each of the problems for van der Sandt's theory that will be discussed in the following subsections to which of these two categories it belongs.

2.1 "Suitability", and Partial Match

It was demonstrated in Chapter 1 that the role which presupposition resolution plays in context update is a two-part process: binding and accommodation. Van der Sandt's theory left us with some unsolved puzzles in each of these two stages. First we turn to binding. Consider the following sentences (They are similar but not quite the same as those raised in Beaver, 2002, p.38):

(38) a. Every criminal believes that the war criminal gets capital punishment.

b. Every war criminal believes that the war criminal gets capital punishment.

(39) a. If a criminal reads the Geneva Conventions, then he knows that the war criminal gets capital punishment.

b. If the war criminal who gets capital punishment reads the Geneva Conventions, then he knows that the war criminal gets capital punishment.

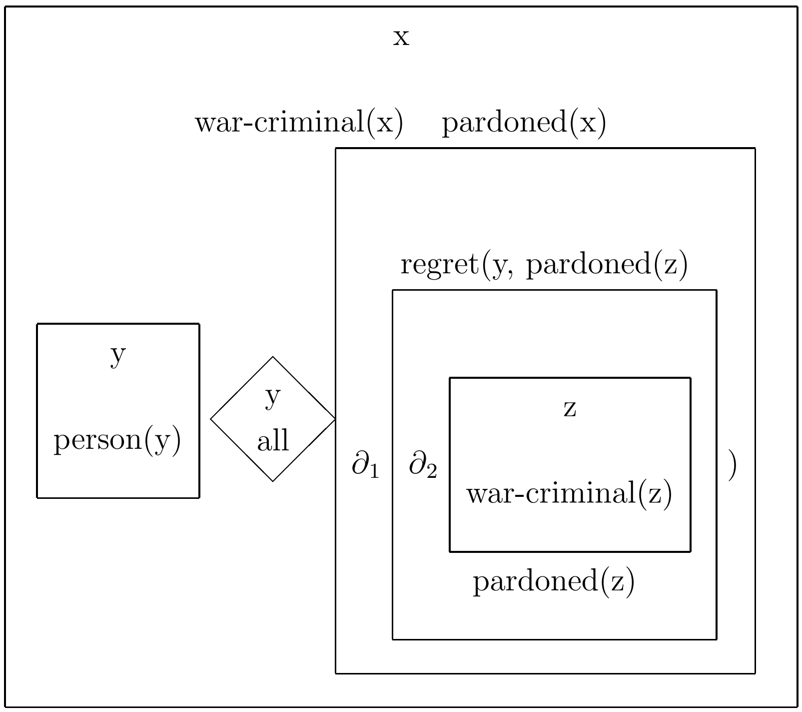
(40) a. A war criminal is pardoned, and everybody regrets that the war criminal is pardoned.

b. A war criminal is pardoned, and every war criminal regrets that the war criminal is pardoned.

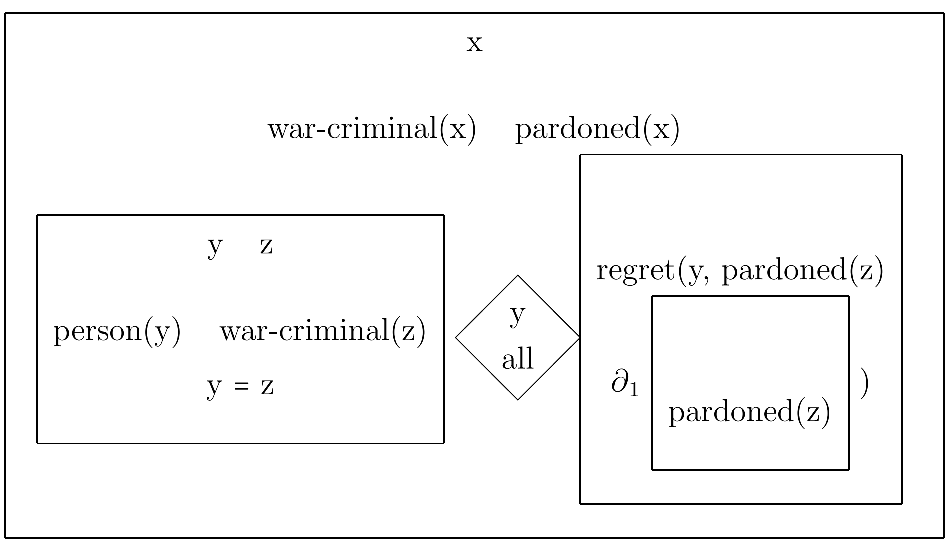
Let's assume that there is a contextually salient and unique war criminal whom the interlocutors have in mind when the above sentences are uttered. This is what van der Sandt's theory predicts about the interpretation of these sentences: Sentence (38b) is the outcome of binding in the intermediate scope in one attempt to resolve for the presupposition triggered by the definite 'the' in (38a). (39b) is the same for

(39a), except with the added intermediate binding for the factive 'know'- the reason accommodation does not take place in the global DRS here is because Definition 9a requires that *binding to a suitable antecedent must always be preferred* over accommodation. And finally, (40b) is when 'everybody' in the restrictor scope binds to 'the war criminal', while the factive 'regret', surprisingly, binds to the global DRS:

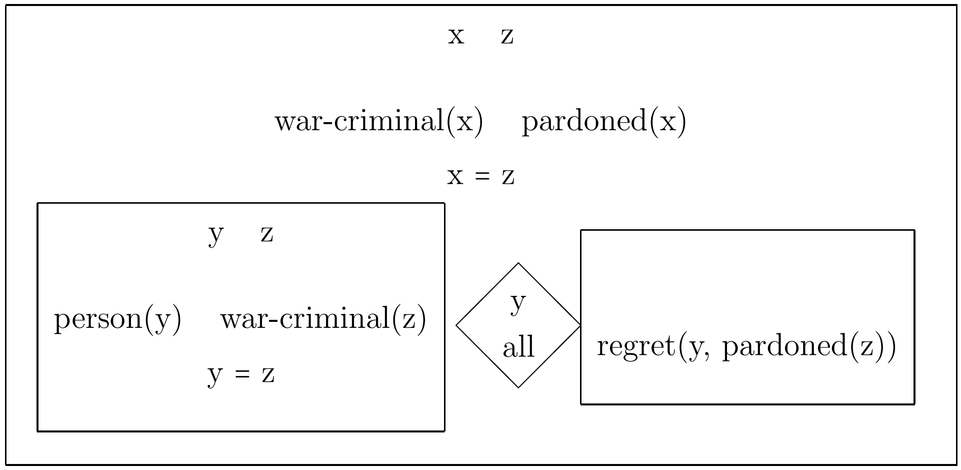
(40) c.



d.



e.



(40c) is the Preliminary DRS with all unresolved presuppositions. (40d) illustrates the resolution of the definite 'the war criminal'. The presupposition marked by ∂_2 binds in the nearest scope which is the restrictor, as 'person' (as in 'body' of 'everybody') and 'war criminal' are compatible with one another as discourse conditions (compatible simply means no inconsistency. One is also free to add the stipulation that every war criminal is a person). (40e) may look like an unlikely step from (40d), but this is not the case, because the place where the remaining presupposition *should* bind (restrictor) does not have the qualifying condition 'pardoned'. The only place where this condition has a match is in the global scope. There are some very confusing points in the process of trying to resolve these presuppositions. First, we are confronted with the choice between resolving the definite in either the global or the intermediate scope. On the one hand, the global DRS has a perfect match for the condition of the definite presupposition ('war-criminal'), but on the other hand, binding preferences instruct us to take the nearest scope, the intermediate, which also has a suitable though less perfect candidate. The second confusion arises when we are trying to resolve for the factive's propositional complement. We are again confronted with a dilemma: Do we bind in the intermediate scope because the discourse marker z is declared there already? Or do we bind in the global DRS because there is already a war criminal who is pardoned, therefore getting the largest number of matching conditions possible? Notice how the Informativity constraint has not been violated in (40e), because the global DRS does *not* entail its sub-DRS.

Defenders of van der Sandt's theory may argue that with cases such as (38)-(40), simple stipulations could be made to reconcile it with cases in which the interlocutors are familiar with a specific war criminal. Stipulation that in scenarios that include the information that the participants of an exchange all have a particular war criminal in mind, then this is a case of binding in the global scope. Presumably, because the discourse context already contains a referent for the war criminal they all seem to think about. There are some problems with this. First, why should unmentioned objects be represented in the *discourse context*, even if they are familiar to the interlocutors? And if they are in the discourse context, does that mean we could simply refer to them with pronouns, provided that their selectional restrictions are not violated, even though they may have never been explicitly introduced via an indefinite (or inferred from other textual information)? These questions are beside the point. Even if we *do* allow for such a stipulation, by assuming everything that the speakers are aware of is stored somewhere where it is accessible to the presuppositions- *the problem of partial match remains.*

Beaver (2001) gave some further examples to demonstrate the inadequacies of van der Sandt's structural account when partial match is involved. Here, instead of relying on the definite as the presupposition trigger, the factive verb is used in its place. In effect, this side-steps the stipulation van der Sandt apologists might be tempted to make, that anything familiar ought to be part of the discourse context prior to utterance:

(41) a. Every farmer who owns a donkey realizes that a purple farmer-eating donkey is on the loose.

b. Every farmer who owns a purple farmer-eating donkey which is on the loose realizes that a purple farmer-eating donkey is on the loose.

(42) a. If a farmer owns a donkey, he realizes that a purple farmer-eating donkey is on the loose.

b. If a farmer owns a purple farmer-eating donkey which is on the loose, he realizes that a purple farmer-eating donkey is on the loose.

Beaver (2001, p. 114) argues that the presupposition that there is a purple farmer-eating donkey on the loose is triggered in the nucleus/consequent position of the universal/conditional, respectively. The antecedent referent for the donkey may be obtained in the restrictor/antecedent scope. Since being a donkey is compatible with being a purple farmer-eating donkey on the loose, binding is licensed, and even preferred, and this subsequently causes the extra information to be accommodated into those scopes.

There is nothing in van der Sandt's binding constraints that prevents us from obtaining the readings found in (38b)- (42b), in fact, those in (38b) , (39b) and (41b), (42b) are the *most preferred* readings by Definition 9a, while (40b) comes out as ambiguous because the rules are insufficient. It is obvious that none of those readings are correct. Instead, these examples entreat us to spell out the binding constraints in much greater detail. To get the correct readings for (38a)- (40a), the definite presupposition should be globally accommodated despite the formal option van der Sandt's theory offers for binding. This (rather superficial) observation suggests two things:

1. Perhaps a constraint could be added to the effect that binding must not add extra information to an antecedent?

2. For certain presupposition triggers, perhaps binding is *not* by default preferred over accommodation after all?

As with our examples, the implementation of the first proposal will forbid the identification of ‘the war criminal’ in the anaphor, with ‘criminal’ (or ‘person’) in the antecedent position. The basis for such a constraint demands further articulation of the notion of ‘suitability’. Recall that in the last chapter, ‘suitability’ simply translates to the matching between constraints on the antecedent and the anaphor. Since matching is a subtask of the binding task, the only guideline given to us in van der Sandt (1992) on how to match is that we may not produce any inconsistent or uninformative DRSs. But how do we pass judgement as to whether one matching is 'suitable' and another is not, when no inconsistency arises? This is one of the main problems we face in (38)- (40). The pairing between 'criminal' (as antecedent) and 'war criminal' (as anaphor) is termed *partial match* (Krahmer & van Deemter, 1998). Partial match is a procedure for identifying non-identity relationships, where the disjunction of the value set of the two discourse referents involved in the match is nonempty. There can be no doubt that a story must be told about partial matches in presupposition resolution.

If we take the route in proposal 1, there is a further problem: What should we do if the universe of the presuppositional DRS is empty? Take (40d) for example, a Preliminary DRS right after the definite is bound but before the accommodation of the factive presupposition (the DRS marked by ∂_1 remains unresolved). Even if we prohibit the identification between discourse referents that results in the antecedent being more informative than before, this does not stop the factive presupposition in (40d) from being merged into the scope of the restrictor[1], thus yielding: "a war criminal is pardoned, and every war criminal who is pardoned regrets that the war criminal is pardoned". The issue is far more complicated here, and I do not believe modification of the binding constraints with respect to partial matches alone will solve it. This is where proposal 2 comes in. Consider the following sentences (Beaver, 2002, p. 38, 30):

(43) a. If John is unhappy then he regrets that he left.

b. If Mary has grandchildren, she must regret she had children.

[1] I use the word 'merge' because it is unclear according to van der Sandt's definitions as to whether this is binding or accommodation. One can argue that it is binding, because the discourse marker z is shared between the presuppositional discourse condition (pardon(z)) and the universe of the restrictor, while the condition y=z is already present in the restrictor. One can also argue that it is in fact, accommodation, because the restrictor does not contain the information that the presuppositional DRS contributes, namely the discourse condition 'pardoned(z)'.

The most intuitive reading for (43a) is probably: "John left. If he is unhappy, then he regrets that he left", a case of global accommodation. However, this is not what van der Sandt (1992) predicts. The way his algorithm works is that since the second occurrence of 'he' is the innermost presupposition, it is dealt with first, and bound to John. The propositional complement of the factive, 'John left', is the next presupposition waiting to be resolved. Upon the resolution of the pronoun, the factive presupposition becomes a sub-DRS *with an empty universe*. Since there is no discourse referent left to accommodate here, I am not sure what is to be done at this point, perhaps we could simply accommodate the condition without its relevant referents, but as a general principle, this is probably undesirable because of the possibilities of free variables. To deal with this, Beaver (2002, p. 37-38) reformulates van der Sandt's binding constraints: Two sets of conditions can be identified with one another so long as it does not result in an inconsistent sub-DRS. He then argues that we should bind the factive in the most local scope, that is, in the consequent of the conditional. As a result, we get: "If John is unhappy, then he left and regrets that he left". This turns out to be very unintuitive for someone who sees (43a), and may not even be correct at all[2].

Karttunen (1973) predicts that the presupposition in (43b) is filtered, or satisfied in the intermediate scope, since having grandchildren entails having children. Nevertheless, it is very natural to interpret the utterance as presupposing that Mary has children: One takes the speaker to assume this to be the case and accommodates accordingly, a reading which would require global accommodation. Van der Sandt's preference for binding over accommodation therefore ought to be cast aside here if we want to obtain this reading (we want to avoid binding with the result of entailment that Mary has children because she has grandchildren). It is unclear as to what extent proposal 2 can be applied, and how exactly it should be applied.

[2] I do not agree with this particular analysis, but I will report it as he describes it.

2.2 Conditional Presuppositions

Presuppositions in cancelation and filtering models (Gazdar, 1979b; Karttunen, 1973; Karttunen & Peters, 1979) always come from a subset of the elementary presuppositions of the complex sentence in which their triggers occur. In a theory such as van der Sandt's (1992) where accommodation is available, what is accommodated must also be derived from those elementary presuppositions. Beaver (2001, p. 121) points out that this is not necessarily the case for actual presuppositions. He gives the following example:

(44) Perhaps if George has arrived, none of the press corps. knows that both George and Al are here.

The presupposition triggered by the factive 'know'- "both George and Al are here"- does not seem to be the right presupposition of the utterance as a whole. What appears to be the actual presupposition by the speaker of (44) is that *"Al is here, but probably not George"*, or the conditionalized: "Perhaps if George has arrived, then both George and Al are here". Van der Sant's resolution constraints would rightfully block global accommodation and accommodation in the scope of modal possibility (Informativity Constraint). However, intermediate accommodation in the antecedent of the conditional is allowed, and this would yield the wrong reading: "Perhaps if George arrived and both George and Al are here, none of the press corps. knows they are here". Local accommodation does not quite correctly capture the meaning of (44) either, even though it does entail the conditional presupposition: "Perhaps if George arrived then both George and Al are here and none of the press corps. knows they are here". There is little explanation as to why 'Al is here' should be the *only* presupposition of (44), with perhaps *one exception* (Kamp & Roßdeutscher 1994b; Kamp 2001a). In these, Kamp and Roßdeutscher introduce the notion of 'presupposition justification', which is a kind of hybrid between presupposition binding, and accommodation. Kamp (2001a) characterizes presupposition justification as follows:

> Often presupposition justification takes the uneventful form of finding

> the given presupposition or presuppositions satisfied in the given context. But not always. In many other cases the context does, as it stands, not quite measure up to the verification task. It doesn't verify the presuppositions as is, but needs adjustment- by "accommodation", as linguistic parlance has it- to fit the requirements that the presuppositions impose. This doesn't mean, however, that whenever direct verification fails, the unverified presuppositions get accommodated lock, stock and barrel. There are many instances where the context, while failing to verify the presuppositions at issue, nevertheless contains much of what is needed for their verification; just a small bit of information is missing to make verification complete. In such cases it is not only possible to achieve accommodation by accommodating just this little bit; as a rule, when such a limited accommodation suffices, that accommodation is highly preferred or even mandatory: Even if other, more comprehensive accommodations are possible which also transform the given context into one in which the presuppositions are also satisfied, the rules of interpretation require the smaller, 'less costly' accommodation. As a consequence, the bit of information that gets accommodated will be perceived as one of the discourse's entailments.

Kamp maintains that presupposition resolution is often neither straight out binding, nor all out accommodation. Binding and accommodation are simultaneously invoked, for the same presupposition trigger. In such cases, one accommodates just as much information as is needed in order that binding can go through. If we apply this hybrid method and try to 'justify' the intended presupposition in (44), we try to bind the factive presupposition "both George and Al are here", seeing that the antecedent of the conditional could partially satisfy that presupposition (since "George is here" is entailed by "George has arrived"), we bind the information concerning George from our original presupposition intermediately. What is left of the original presupposition ("Al is here") will then be accommodated in the global scope. This seems to be a plausible solution to this type of conditional presuppositions since the reading we obtain is the one we want.

Beaver (2001) on the other hand, attributes the problem shown in (44) to the deficiencies of pure *structural* accounts of accommodation: What is accommodated is strictly drawn from amongst the elementary presuppositions of a complex sentence. A devastating weakness of structural accounts such as the one by proposed by van der Sandt is its inability to produce conditional presuppositions (Beaver 2001, p. 122):

(45) If Spaceman Spiff lands on Planet X, he will be bothered by the fact that his weight is greater than it would be on Earth.

Beaver notes that since 'bothered by', and 'fact that' are presupposition triggers, if we follow the structural account, there is the presupposition: "Spiff's weight is greater than it would be on Earth". Van der Sandt's model will predict global accommodation: "Spiff's weight is greater than it would be on Earth. If Spaceman Spiff lands on Planet X, he will be bothered by the fact that his weight is greater than it would be on Earth". This reading is clearly wrong. The actual presupposition of the statement in (45) is a conditional one, and should be: "*if* Spiff lands on X, his weight will be greater than it would be on Earth"[3]. Kamp's justification account will give us this presupposition projection *only if* we first accommodate the general knowledge that one's weight is greater on planet X than it is on planet Earth- a kind of bridging inference that may arise from sentences such as (45). Once this information is accepted into the common ground, the presupposition "Spiff's weight is greater than it would be on Earth" is satisfied by the antecedent of the conditional statement, since it is entailed by Spiff landing on X and the information that was just accommodated (that one's weight on X always exceeds one's weight on Earth). Again, this seems to

[3]Beaver and Zeevat (2006) suggest that examples such as (45) in fact should have a much stronger accommodation, *the speaker might plausibly be assuming that Planet X has a particularly high gravitational field, such that whenever someone lands on X, that person weighs a lot*. If this is indeed the presupposition of (45), then its accommodation will result in *more* information than is minimally needed, thus going contrary to Lewis' (1979) view on accommodation.

be a plausible solution, but some arbitrary stipulations seem to call for explanation. First, how do we decide what bridging inference should be globally accommodated? And second, how do we make use of these bridging information? The difficulty in formulating general principles for these is due to the fact that their answers tend to be situation dependent.

If we return to Beaver's analysis, it appears that local accommodation gets us closest to this mark: "If Spaceman Spiff lands on Planet X, his weight will be greater than it would be on Earth and he will be bothered by the fact that his weight is greater than it would be on Earth", but nothing in van der Sandt's theory indicates that this should be preferred. If only we could modify the rules to eliminate global and intermediate readings from such examples, the validity of structural accounts might be preserved, but Beaver argues that matters are not quite as simple:

(46) a. It is unlikely that if Spaceman Spiff lands on Planet X, he will be bothered by the fact that his weight is greater than it would be on Earth.

b. If Spaceman Spiff lands on Planet X and is bothered by the fact that his weight is greater than it would be on Earth, he won't stay long.

The conditional presupposition is the same for (46) as it was in (45): "*if* Spiff lands on X, his weight will be greater than it would be on Earth". Van der Sandt's structural account will not only fail to yield the correct accommodation (global), but local accommodation is not even available for (46b). If we try to accommodate (46a) locally, we get: "it is unlikely that if Spaceman Spiff lands on Planet X, his weight will be greater than it is on Earth and he will be bothered by it". This is definitely the wrong reading, because instead of implying that if Spiff lands on X his weight will be greater, local accommodation says the opposite, that Spiff's weight is *unlikely* to be greater if he lands on X. The scope of 'unlikely' should not extend over the accommodated material, but unfortunately, there is nothing we can do in the structural account to avoid this. The moral of the story, as Beaver tells it, is that *we cannot expect the accommodated material to be provided by knowledge of grammar alone*- it is impossible to determine on structural grounds alone the appropriate accommodation strategies and the content in which we must accommodate. Rather, *the accommodation material can only be calculated with reference to the way in which world knowledge and plausibility criteria interact with the meaning of a given sentence* (Beaver, 2001, p. 121).

The analyses of Beaver and Kamp bring us to the phenomenon of bridging, where a new discourse entity is linked to an old one though some form of partial match[4].

2.3 Bridging and Partial Match

There are many instances where world knowledge, knowledge about the meaning of certain words and their relations, play important roles in presupposition resolution. There is the problem with partial match, when sometimes the antecedent and the anaphor have compatible conditions (binding them would not produce any inconsistency), and yet binding is not permissible because that gives the wrong reading. The first sub-section of this chapter dealt exclusively with instances in which bad binding decisions can be avoided by ruling out those cases where the antecedent

[4]Beaver (2001, p. 115, p. 123) draws an analogue between the examples presented in this sub-section to the examples found in McCawley (1979) and Karttunen (1973). He argues that they are essentially the same type of conditional presuppositions and face the same problems:

(i) If Nixon invites Angela Davis, then Nixon will regret having invited a black militant.

(ii) If Nixon invites Angela Davis and Nixon regrets having invited a black militant, then he will organize a cover-up.

(i) has the sentence form "If A then B_C", where B carries the presupposition C. The relevant conditionalized presupposition for (i) is therefore "If A then C". Local accommodation yields: "if Nixon invites Angela Davis, then Nixon will have invited a black militant and regret it". This reading seems correct, because it entails "if Nixon invites Davis, then he will have invited a black militant". Van der Sandt's structural account would have us accommodate globally instead, as we did in (45), which is clearly wrong. Suppose we force accommodation of conditional presuppositions in the local scope, then we run into the same problem in (ii) as we did in (46b).

gains new information from the anaphor. In this section, I would like to reinforce Beaver's intuition in the previous sub-section and argue that the problem related to partial match is more complicated than previously believed- not only that it cannot be solved through structural methods, but the solution extends far beyond linguistic knowledge. Consider the following:

(47) a. If John is limping, Mary realizes he is hurt.
b. If John is visiting, Mary realizes he is hurt.

At first glance, (47a) appears to be a typical filter construction according to Karttunen (1973)- in van der Sandt's terminology, the presupposition triggered by 'realize' seems to be locally satisfied. The reason for this is because people typically expect limping to be due to some form of physical injury, and having such injury is in one sense, 'being hurt' (one can also be hurt mentally or financially). Therefore, since the antecedent of (47a) entails the presupposition of the consequent, the presupposition of the factive 'realize' does not project. In order to mimic the effect of this type of filtering in van der Sandt's model, there are a few options of accommodation we can choose from:

1. Global accommodation of the clause "Everyone who limps is likely to be hurt".
2. Intermediate accommodation of "If John is limping then he is hurt (or, is likely to be hurt)".
3. Global accommodation of "If John is limping then he is hurt".

Any of the above strategies will give us the entailment from 'limping' to 'being hurt' which we need in order to locally satisfy the presupposition of 'realize' (specifically, binding in the intermediate scope). The first one is more of a lexically based stipulation, or a meaning postulate. It assumes that anybody who limps is likely to be hurt, which seems to be a reasonable assumption. The second strategy does not really have any basis, although it will also give us local satisfaction for the 'realize' presupposition, by having within the intermediate scope of (47a): "John is limping, if John is limping then he is hurt, so he is hurt". Nevertheless, option 2 produces a rather odd sentence ("if John is limping and if he is limping then he is hurt, then Mary realizes he is hurt"), therefore we may completely abandon option 2 from our consideration. The final option, 3, is a kind of contextual stipulation that reflects a certain knowledge on the part of speaker in which the hearer is not yet aware of, but nevertheless is willing to take for granted. Specifically, the speaker of (47a) knows that whenever John limps, he is hurt. The accommodation in option 3 is in the spirit of Stalnaker's (1974) speaker presupposition that was introduced earlier. A hearer will always try to accommodate the information that will help admit an utterance into his context, as long as he believes that the speaker is knowledgable about the information.

Van der Sandt's theory on the other hand, would predict global accommodation of the condition that John is hurt. But this is the wrong reading for (47a). (47a) should read: "If John is hurt and limping, Mary realizes he is hurt" (as meaning: "If John is limping *because* he is hurt, Mary realizes he is hurt", a result of the entailment from option 1-3). The way in which entailment between word meanings is handled in DRT here is very primitive, and we may even get a little uncomfortable when forced to explain why 'limping' should always entail 'being hurt'. But if we ignore this small technicality, then this is so far so good…

(47b) has the same conditional construction as (47a), except that it is not a filter because 'visiting', as far as anyone moderately competent in the English language is concerned, does not entail 'being hurt'. The prediction is projection/global accommodation: "John is hurt. If he is visiting, Mary realizes he is hurt". Here van der Sandt gets it right.

The task of determining the scope of resolution for the factive presupposition is far more difficult than the primitive stipulation we had about entailments would have us believe. One may look at (47b) and argue that 'visiting' has nothing to do with 'being hurt', therefore it is natural that the presupposition projects. But this is not true, if we look again, (47b) highlights the importance the speaker places on whether Mary has visual contact with John's physical condition. Presumably, Mary will not see him unless he visits, and only if she sees him will she perceive his physical injuries and come to learn, as the speaker has, that John is hurt. The visual contact is apparently not an issue in (47a). Even though the only difference between (47a) and (47b) is *just one word*, completely different resolution strategies must be devised in order to obtain the correct readings. But the meaning of words and the relation between meanings are not the only things that affect resolution. Here is an example where world knowledge plays a certain role:

(48) a. If Luke Skywalker is misled by Emperor Palpatine, he will regret that Darth Vader is his father.

b. If Luke Skywalker watches 'The Empire Strikes Back', he will regret that Darth Vader is his father.

Once again, the sentences in (48) are filter constructions. While (48b) should project (global accommodation), (48a) should not (local satisfaction). Even though this intuition does not come quite as strongly as it does in the examples shown in (47), the different variations in the antecedents seem to dictate our presupposition resolution strategies just as before. In case the readers are not familiar with George Lucas' *Star Wars* movie trilogy spanning the period between 1977 and 1983, 'The Empire Strikes Back' is the second episode. In the story, the villain named Darth Vader revealed to the protagonist Luke Skywalker that he was his father. The other world knowledge the readers will need in order to understand (48a) is that Emperor Palpatine is another villain in the story, notorious for his cunning and deception. (48a) is curious because the factive seems to suggest that Darth Vader is Skywalker's father, *but only in the mind of Skywalker*, and not necessarily true *per se*. Perhaps this has something to do with him being misled by the grand trickster of the epic, Palpatine, who lied to Luke about his father (being Vader) for the purpose of making him feel bad and regret. But we cannot simply stipulate an entailment from 'misled' to 'Darth Vader being Skywalker's father' like we did with 'limping' and 'being hurt' back in (47). It would be ridiculous to globally accommodate "everyone who is misled by Palpatine has Darth Vader for his father", or anything in that strain. Luckily, Klein (1975) comes to our aid and points out that the subject's belief is sufficient to satisfy the presuppositions of an emotive factive such as 'regret'. The only problem here is that the presupposition of (48a) is not triggered within the scope of Skywalker's belief context. If we still decide to make a stipulation however, 'being misled' would entail Skywalker holds the belief that Vader is his father. Global accommodation is therefore ruled out, the presupposition of Darth Vader being Skywalker's father appears to be satisfied in the antecedent.

Standing in stark contrast with (48a) is the rather comical statement (48b). (48b) states that if Skywalker would simply watch the movie that he himself starred in, he will see that Darth Vader is *in fact* his father, and he is going to regret it. There is very little doubt in this case that the factive presupposition is projected to the global scope. Maybe it has something to do with (48b) being uttered from the point of view of an outside observer, who is trying to make the point that Luke Skywalker is kept in the dark about who his father is unless he steps outside of his character and sees things from the observer's point of view. (48b) is similar to (47b) in that it highlights the importance the speaker places on whether Skywalker is privy to the insights he himself as an outsider has access to, just as (47b) highlights how visual contact with John is a necessary condition for realizing he is hurt.

The stipulation we have been making for (47a) and (48a), is a kind of *bridging* reminiscent of the ones below (Beaver, 2002):

(49)
a. Jane sat in the car. She adjusted the rear-view mirror. (Mirror linked to car)
b. If I go to a wedding then the rabbi will get drunk. (Rabbi linked to wedding)
c. An old woman hit me. The brass knuckles cut deep. (Brass knuckles linked to old woman)
d. When you dismantle a hyper-space drive unit, firstly remove the head

stratifier, but remember to hold your nose. (Head stratifier linked to hyper-space drive unit)

Each of the above examples suggest some kind of relation, or link between the individuals mentioned. The links are *not* derived from some general principles- since rabbis do not generally show up at weddings, just as old women typically don't wear brass knuckles. The links are stipulated in order to make the most sense of the individual sentences. Each of the bridging links in (49), as in (47a) and (48a), are between partial matches. The ways in which we bridge these partial matches are either through some form of entailment between the meaning of words (like (47a)), or via some elaborate set of reasoning and heuristics (cars have rear mirrors, the weddings could be Jewish, Palpatine intended to make Skywalker sad because he is evil, etc.). The information we gain through bridging can be *accommodated*, this accommodation *need not always* take place in the global scope, but it often does, and either way it will have far reaching consequences for the presupposition resolutions that follow, as we saw in (47a) and (48a). It is unclear how we derive bridging information, however, and exactly how or where we should accommodate it. Van der Sandt's model has nothing to say about this, and what's worse, there simply isn't any competing theory of presupposition that can perform better.

It is worth noting that the examples in (47b) and (48b) have in common a certain unique position which the speaker assumes for himself: The speaker of (47b) presumably has already seen John before he uttered (47b); the speaker of (48b) is very likely in a position where he has already watched 'the Empire Strikes Back'. As soon as the hearer of these utterances becomes aware of the position which the speaker assumes, and decides to accept it, global accommodation suddenly overwrites bridging and entailment and filtering is blocked. I fully admit that these are very rudimentary speculations, but again nobody has ever looked into these types of sentence constructions closely enough. My final remark on the matter: It appears that the unique position assumed by the speaker is responsible for factive projections in general, this is perhaps because the global context generally represents the new common ground, which is attributed to the speaker and is a representation that includes all of the speaker's assumptions.

The puzzles presented here certainly cannot be answered by linguistics alone. Why does the change of a few words makes a presupposition disappear or emerge? I expect the answer to be ontological and epistemological in nature.

2.4 Cancelation

Cancelation typically refers to cases where a presupposition is not projected due to some conflict or inconsistency between the presupposition and other information in the discourse. Here is a well known example:

(50) France has no King, and the King of France is not bald.

(50) is a phenomenon that is essentially tied to negation and it is a special instance of Horn's (1985; 1989) general observation that negation can be used to deny any number of aspects of an utterance that have to be satisfied in order for a claim to be correct (and felicitous). Such uses are most natural when reacting to utterances by someone else that are deficient in one way or another, and where the reaction (the statement with the negation) targets that aspect of the utterance that is the cause of its deficiency. Presupposition failure is one of those targets. And indeed, sentence combinations like (50) are hard to make sense of unless they are reactions to someone else who has made an utterance carrying the faulted presupposition. Here the term "cancelation" is aptly chosen, since the denial of the presupposition signals that the presupposition is not to be considered in the statement this denial accompanies that one is false precisely because its presupposition fails and thus it can be false instead of lacking a truth value.

Things look a bit awkward in Van der Sand's model when we try to process such sentences however. The assertion in the first sentence of (50) conflicts with the presupposition of the second. The Consistency Constraints will prevent global accommodation of the unique French King. The next and only option is to locally accommodate in the scope where the presupposition is originally triggered. But if we do this, we violate the Informativity Constraint:

$$\begin{array}{|c|}\hline f \\ \\ \text{France}(f) \\ \neg \begin{array}{|c|}\hline y \\ \\ \text{King}(y) \\ \text{have}(f,\ y) \\ \hline \end{array} \quad \neg \begin{array}{|c|}\hline z \\ \\ \text{King-of-France}(z) \\ \text{bald}(z) \\ \hline \end{array} \\ \hline \end{array}$$

The information in the left sub-DRS is exactly the same as the right because they map to the same individual in every Model (they have identical value sets). If local accommodation is prohibited, then there is nothing else we can do, and the algorithm in Definition 9b would instruct the program to abort, indicating an error. But there is nothing wrong with a sentence like (50), so this should not happen. Beaver (2002) sketches some proposals to ameliorate this situation: Since not all speech acts are informative, perhaps we should make informativity a constraint only on assertive sentences, but not on denials. Furthermore, we may claim that informativity is not an absolute constraint, but only a preference- when two readings are available, then either the more informative one or the one with the least redundant sub-DRSs is the most preferred. These proposals have not been spelled out in any detail, so it remains to be seen whether they indeed solve our problem instead of getting us into new ones.

2.5 Filtering

Recall that in Definition 1 in the last chapter, "either A or B" is a filter construction- if the negation of sentence A entails the presupposition of B, then the presupposition does not project, it is instead, *filtered* (Karttunen, 1973), or in van der Sandt's term, locally bound/satisfied. Karttunen gives the correct readings for the following sentences. Van der Sandt, however, runs into some problems (Beaver, 2001):

(51) a. Either John didn't solve the problem or else Mary realizes that the problem's been solved.

b. Either Mary's autobiography hasn't appeared yet, or else John must be very proud that Mary has had a book published.

c. Maybe John has a daughter. If she is over 18, she has probably left home.

The local context in the first disjunct of both (51a) and (51b) contains a condition which, if negated, entails the presupposition in the second disjunct. The factive presuppositions are therefore filtered. This seems reasonable, until we try to work out the same results in DRT- and suddenly we are surprised that the first disjunct is not anaphorically accessible from within the second disjunct due to the negation, so binding is ruled out. Van der Sandt's theory will then yield global accommodation for the sentences in (51): "The problem has been solved and either John didn't solve it or else Mary realizes it has been solved"and "Mary has had a book published and either her autobiography hasn't appeared yet or else John must be very proud that Mary has had a book published". Neither of these readings are sound. Either some modifications have to be made to permit certain binding/accommodation within the scope of negation, or the constraints on accessibility has to be loosened up in circumstances such as these.

Although (51c) is not an example of filtering, it nevertheless suffers from the same problem as (51a) and (51b) in that anaphoric binding is made impossible because the scope of the modal operator is inaccessible to the pronominal anaphor[5]. Again, the same solution could be applied to help us get around this.

2.6 Intermediate Accommodation

One of the most controversial aspects of van der Sandt's presupposition resolution is probably its allowance for intermediate accommodation. Consider the following sentence (Beaver, 1994b):

(52) * Few of the 15 team members and none of the 5 cheerleaders have cars, but every team member will come to the match in her car.

A Preliminary DRS for (52) would have the information from the first sentence in its global scope. The second sentence constitutes a duplex condition in which the presupposition triggered by the possessive 'her' is located in the nucleus of the universal quantification. According to van der Sandt (1992), this presupposition should accommodate intermediately: "every team member who has a car will come to the match in her car". This is the same strategy that helped solve (28a) in the last chapter:

(28a) Everyone who serves his king will be rewarded.

Or if we move the trigger to the consequent position:

[5]Beaver and Zeevat (2006, p. 9) have proposed accommodation in the antecedent of the conditional: "Maybe John has a daughter. If John has a daughter and she is over 18, then she has probably left home". I do not think this reading should be available, despite how reasonable it sounds. My argument for this is I believe that in principle, pronouns should *never be allowed to accommodate* in the discourse context and must always find their antecedents there.

(28a)′ Everyone will serve his king.

Accommodating the presuppositions of the definites in the restrictor scope of these sentences yields the readings: "Everyone who has a king and serves his king will be rewarded" and "Everyone who has a king will serve his king" respectively. Judging from these examples alone, intermediate accommodation may come across as a shot in the arm, but much to our dismay, this does not work for (52). (52) is empirically proven to be infelicitous, and any viable theory of presupposition should rule out intermediate accommodation reading for such cases. The same problem arises in conditional statements (Beaver, 2001):

(53) a. If Mary buys a car, she will sell her Cadillac.

b. If a woman buys a car, she will sell her Cadillac.

While (53a) has a global accommodation/projection reading, this is blocked for (53b) due to the Trapping Constraint in Definition 9a. The next step for (53b) is to try and accommodate intermediately, which will lead to: "If a woman who owns a Cadillac buys a car, she will sell her Cadillac". But this is not what (53b) means. The meaning of (53b) has the odd implication that *every woman has a Cadillac*. Intermediate accommodation of (53b) turns out to be a rather contrived rationalization of (53b), and like (52), it looks as if a presupposition trigger in the consequent of a conditional should not be allowed to accommodate in the antecedent.

Beaver (2001, p. 119) gives the following insight: "It should be borne in mind that some explanation must be found for the fact (and I take it to be so) that the claimed intermediate accommodation readings have only been found to occur in sentences that have a distinctly generic flavor". Beaver provides the following contrasts to illustrate this point:

(54) a. Every German woman drives her car to work.

b. Between 9:00 and 9:30 yesterday, every German woman drove her car to work.

The intermediate accommodation reading is plausible for (54a)- “Every German woman who has a car drives her car to work”. But as soon as the genericity is removed, as in (54b), it appears that *global accommodation is preferred*- The meaning of (54b) appears to have an implication that every German woman has a car, despite how counterintuitive that may sound.

2.7 Multiple vs. Single Accommodation

It was discussed in Zeevat (1992), Beaver (1997; 2001) and Beaver and Zeevat (2006) that there are two different strategies for accommodation in representational approaches such as DRT. The first of these two is found in van der Sandt (1992), Geurts (1999), Kamp et al. (2008), where a presupposition moves from the triggering position up along the accessibility path, seeking to bind, and when binding is impossible, accommodation takes place in a distant site from the triggering position. Each trigger only has one accommodation site. An alternative is proposed by Fauconnier (1985) and argued in Zeevat (1992), and also implicit in Heim's CCP (Heim 1983b). In Fauconnier's representationalist model, meanings are a structured collection of interconnected mental spaces, mental spaces which are similar to DRSs in many aspects. Both are partial models with discourse entities, properties and relations. They both are arranged hierarchically with subordinate relations between the internal structures[6]. If we assume a mental space to be just a DRS box, and assume a DRT-like notion of accessibility, Fauconnier's version of presupposition accommodation involves accommodation in multiple contexts- the information that is needed to satisfy the presupposition is first accommodated in the local context, and then spreads upwards along the accessibility path, leaving a copy in each and every successively more global contexts until some resolution constraint prevents further expansion. So under Fauconnier's theory, presupposition floats upward leaving a clone of itself in every scope it passes, and in van der Sandt's theory, presupposition simply “bubbles

[6]For a full list, readers are referred to Beaver (2001, p.129). I will only briefly mention the attributes which are relevant for our comparison of the two accommodation strategies.

up".

Zeevat (1992, p. 396) makes the distinction between two classes of presupposition triggers: *anaphoric* and *lexical* presuppositions. The former always resort to van der Sandt's single accommodation strategy, while the latter class adopts Fauconnier's multiple accommodation. Anaphoric presuppositions, in Zeevat's words, "their primary function is- like anaphora- to collect entities from the environment in order to say new things about them". Examples are definite descriptions, factive *when*- and *after*- clauses, clefts, *too* and *again* etc. Beaver (2001) illustrates this point with the following example:

(55) a. Bill called Mary a Republican. And it is clear from Mary's diary that John insulted her too.

b. It is clear from Mary's diary that Bill insulted her.

The speaker of (55a) intends to use the trigger *too* to imply that Mary was insulted by somebody other than John in the context of utterance. A hearer would be inclined to deduce that calling somebody a Republican would constitute an insult, therefore Bill insulted Mary- this information is globally accommodated. This however, does not licence (55b) even on the basis of (55a), because for all we know, Mary may not have said anything about Bill in her diary. Van der Sandt's strategy is therefore preferred here, we only need to globally accommodate 'Bill insulted Mary' for (55a).

Lexical triggers, as Zeevat puts it, belong to a class of concepts in which "the application of (the) concept is only an option if certain conditions are already met. These conditions... are the lexical presuppositions of the concept". The presupposition of the lexical trigger therefore must hold in any context where the trigger appears if the concept is to be meaningful at all. Factive verbs belong to this class, and the same is true for aspectual modifiers which presupposes certain actions or states (e.g. "it stopped raining"). Lexical triggers should not only be accommodated in the highest suitable site, but also locally along its projection path. Beaver (2001) uses the following example to illustrate this point:

(56) a. Bill called Mary a Republican. And it is clear from Mary's diary that Bill thinks she realized that he had insulted her.

b. It is clear from Mary's diary that Bill insulted her.

c. It is clear from Mary's diary that Bill thinks he insulted her.

Both (56b) and (56c) follow from (56a). (56b) is when the presupposition from 'realize' is projected in the global scope of the second sentence. (56c) is a spill over from (56b) when the presupposition is accommodated the way in which Fauconnier and Zeevat suggested- locally and along the projection path- in this case a copy of the presupposition is registered in the scope of 'thinks'. Beaver considers sentences like these to be counterexamples not only to van der Sandt's theory, but to any theory where accommodation can occur in only one site. A very delicate observation made by Zeevat and Beaver is that it is only when lexical presuppositions are embedded in intensional contexts that multiple accommodation is required:

(57) a. Mary thinks it unlikely that it will stop raining.

b. Fred thinks Mary doesn't know that she won.

c. Mary hopes that it will stop raining.

d. Mary doubts that it will stop raining.

(57a) suggests not only that it is raining, but also that Mary thinks that it is raining. (57b) has the entailment that Mary won, *and* Fred thinks that Mary won. Things are a bit more complicated than just straight out accommodation everywhere however- Neither (57c) says Mary hopes it is raining nor does (57d) say she doubts it is raining. Instead, (57c) means the speaker and Mary *believe* that it is raining, but Mary hopes that it will stop, and (57d) implies that the speaker and Mary *believe* that it is raining, and that Mary doubts it will stop. Van der Sandt's single accommodation account will not give us any of these readings in the examples shown in (57). Even so, (57c) and (57d) demonstrate that Fauconnier's multiple accommodation alternative is insufficient too. Some kind of modification must be made to it such that *both the speaker and the agent of the attitude verb share the* *same accommodation*. Interestingly, the reader may recall that it was Karttunen (1974) who first sketched out a mechanism in which presuppositions triggered under the belief context of the speaker could be transformed into presuppositions which themselves involve belief contexts- According to Rule 3 of Definition 2- a context will admit a belief sentence if the sentence that acts as complement to 'believe' belongs to the set of beliefs attributed to the speaker of the sentence. Furthermore, if the speaker believes S, a sentence which he just uttered, and S has a belief context involving an agent A, who believes in S′, then the context will admit S if S′ is admitted by the set of beliefs attributed to agent A *and* the speaker. As we can see, presupposition projection in attitudinal contexts can be very nuanced, and there is clearly a lot of work that needs to be done in this area.

2.8 Presupposition Interaction

A rather unfortunate side effect of setting up controlled experiments is that we are kept in the dark about the variables which we try to suppress in order to minimize the unintended extraneous influences. Semanticists are not exempt from this. The majority of presupposition studies tend to focus on the projection problem, and they do so by concentrating on single presuppositions, studying how they behave in various contexts. In this pursuit, we have grown accustomed to setting up simple examples which overlook one crucial aspect- *presupposition interaction*. To my knowledge, there has only been one attempt in the contemporary literature that turned to this issue (Kamp, 2001a), even though presupposition interaction is a very commonplace phenomenon.

Although embedding is a sufficient condition for the interaction between two presuppositions, presupposition interaction goes far beyond what we have seen in typical embeddings where a presupposition appears within a non-presuppositional construction (such as conditional or quantifying expressions). In order to be able to analyze how presuppositions interact, we must first know how those different presuppositions are computed when taken in isolation, as well as precisely what their semantic content is. These are two separate but interdependent issues. The former will be explained in the next sub-section. The latter is a topic that has been overlooked at least since Karttunen (1974), and for all we can tell, was not discussed before that time either. In the literature, the context in which a presupposition is admitted is as close as we come to visualizing its semantic content. But what precisely individual presuppositions consist of, what sort of referential functions they serve and what types of conditions are involved are questions that are completely brushed aside. If we want to know how presuppositions interact with one another, and about the outcome of such interactions, then it becomes imperative that we inquire into the meaning of individual triggers using the logical framework we choose to work with.

To illustrate how presuppositions interact, consider these examples:

(58) a. Walter's rabbit is on the run again.
b. The King of France regrets that Walter's rabbit is on the run again.
c. John did not pass the exam. I know this because I know he did not show up at the exam.

As innocuous as (58a) may seem, there are at least two different readings one can derive from it, involving a wide scope and a narrow scope reading for the adverb 'again', respectively. The narrow scope reading is not so complicated, Walter has a rabbit, and *that rabbit* is on the run now, as it was before[7]. The wide scope reading of 'again' is not quite as straightforward- it potentially entails that Walter has more than one rabbit (over some period that includes both on-the-run events), one of them is on the run now, but *another*, *different* rabbit was on the run before. The 'interaction' takes place between the presupposition trigger in form of the definite description ('Walter's rabbit') and 'again'. By virtue of the presupposition of 'again', the event or state that falls under its scope is duplicated and this copy is placed in

[7]For simplicity, I am ignoring the possibility of restitutive interpretations of 'again'.

a prior reference time. By taking wide scope over the definite, two distinct discourse referents may independently satisfy the conditions specified in the scope of 'again'. The reason for this is because the definition description is different from proper names (e.g. Walter) in that *Definite descriptions need not refer directly, but can also refer via unique satisfaction of their descriptive content (usually within some contextually demarcated domain).* This means that while 'Walter' must always be anchored to the same individual, 'Walter's rabbit' that ran away prior to the event described in (58a) could well be a different rabbit than the one that is said to be on the run right now, so long as the descriptive contents are satisfied. To drive the point even further, the semantic representation for (58a) with a wide scope 'again' should be compatible with the following possibilities: 1. A single rabbit owned by Walter was on the run and is now on the run again. 2. A different rabbit was on the run before than the one being on the run this time. 3. The rabbit on the run before belonged to Walter when it was on the run, but no longer does at the time when (58a) is uttered. 4. The rabbit that is on the run at the time of (58a) may not have been Walter's when the last rabbit was on the run.

An opportunity to capitalize on our reader's familiarity with the non-existing King of France finds its way into (58b)- *Given a context* as established in (58a), how do we decide whether (58b) is true or not? The standard view found in projection theories generally contends that if one presupposition fails, then the entire sentence should fail to obtain a truth value, or as Strawson puts it, the sentence is *meaningless*- end of the story. I am not so sure if this is the end of the story though. Take (58b), clearly, even if (58b) should have no truth value for lack of King of France, its *other presuppositions*, such as Walter, his rabbit, and the occurrences of such a rabbit being on the run- they should have their place in the context nevertheless. The way I see it, this is not a problem about truth value interpretation, but rather, a problem about failure to bind and failure to accommodate- what should we do with the other presuppositions in the same sentence? A theory of presupposition interaction would obviously have to account for occasions when certain presuppositions fail while others succeed, and what to do under each of the circumstances.

Another interaction can be found in (58c). What happened here is that the presupposition of 'passing the exam'- namely that *John showed up at the exam* (and did the exam)- is canceled by the presupposition of the second 'know'. There are many examples of presuppositions interaction in day to day life, and their varieties go far beyond those mentioned in (58).

2.9 How did we get these DRSs in the first place?

Although there has been much discussion on how presuppositions in the form of DRSs ought to be resolved in different contexts, it strikes me that a question has not been asked up until this point: Where did all these Preliminary DRSs come from? If we are indeed serious about how presuppositions of complex sentences are projected from their parts, then we ought to start from the most fundamental parts of these sentences. Assuming a word is the smallest building block to compositionally makes up a sentence, a prudent investigation of the projection problem ought to begin with a study of the words- whether they are presupposition triggers or not. In van der Sandt (1992) and subsequent works adapting the same dynamic approach, explicit definitions of the procedures that yield semantic representations are completely absent. In fact, there is a general lack of systematic proposals for a syntax-semantic interface that includes the presuppositional phenomena[8]. A syntax-semantic interface must accomplish two vital and interrelated objectives: On the one hand, we must have a systematic method to construct semantic representations (in the form of a DRS) from any given syntactic structure (of any commonly accepted syntactic framework). On the other hand, the semantics of the sentence as a whole should be based on the contributions of the words which appear in the sentence. Our primary interests here are presupposition triggering words: What do the DRSs look like that represent the presuppositions they trigger, and how are these presuppositional

[8] With the exception of works by Kamp (2001a), Kamp/Roßdeutscher (1994a), and Blackburn/Bos (1999).

representations integrated, within the overall DRS representation of the sentence in which these triggers appear.

2.10 A Lexical Perspective

Throughout this chapter I have tried to put together a list of the most pressing issues that the DRT treatment of presuppositions faces today. It is difficult to draw a single connection that links all the points, and I certainly do not believe that there is one panacea to solve them all. However, many of them do suggest a 'missing link'- while we have been busy deducing general principles that govern all presuppositions, or an entire class of triggers (such as factives), we have neglected the impact made by individual words, whose meanings inevitably involve presuppositions, and we have also failed to consider the role that world knowledge plays in the interpretation of those meanings. This point is perhaps most potently demonstrated in examples (38)-(40), which involve partial match. When the relevant information associated with an anaphor is different in expression but nevertheless compatible with that of its antecedent, it was shown, the resolution strategy to be adopted should depend on the relation between that information and the information connected with the potential anaphoric antecedents for the expressions. The relation between two partial match candidates only becomes available once we have the means to compute the meaning of the words in question. On this view, the question of 'suitability' of an anaphoric resolution can be seen as part of the bigger puzzle of partial matching. Suitability conditions can only be articulated in a theory that takes into account the idiosyncratic meanings of individual words. World knowledge is indispensable as a consequence of the attention that is paid to individual word meanings; this is why it is not a coincidence that bridging almost always occurs in the form of partial match. As we have seen in this chapter, specifically in our discussion of the examples given in (45)-(49), bridging too can alter the way in which presupposition resolution unfolds. These examples demonstrate that bridging links often take priority over what traditional projection theories (based on strict structural relations) tend to predict.

This is not to say that van der Sandt's theory of presupposition can be completely vindicated by a lexical approach to presupposition triggers. The cancelation (50) and filtering (51) counterexamples discussed in this chapter show that some minor adjustments of the basic constraints in the theory could be made to improve its coverage. The problem of intermediate accommodation that is demonstrated by (52)-(54) however, is a lot more serious, and requires us to rethink the issue related to quantificational domain restriction. Domain restriction is a topic in its own right, with many ramifications outside the theory of presuppositions (Barwise & Cooper, 1981; Stanley & Szabo, 2002, etc.).

The contrast between single versus multiple accommodation ((55)- (57)) was shown to be closely connected to the class of triggers involved: *anaphoric*, and *lexical*. This is another indication that resolution constraints cannot be defined for all presuppositions across the board. In response to this, I intend to adopt a reductionist[9], and perhaps even radical perspective that emphasizes the importance of individual word meanings and the role they play in constructing semantic representations. This entails a need to define lexical entries so that the correct DRSs may be constructed for utterances in which the relevant words occur. The most unconventional aspect of such a lexical perspective is perhaps how we incorporate those presupposition resolution strategies that are needed for the presuppositions generated by a word as *part of the meaning of the word itself*. This makes it possible to customize each of the

[9]According to various encyclopedias ("Reductionism", 2010a; "Reductionism" 2010b), Reductionism is a way of understanding the nature of complex objects or theories by reducing them to the interactions of their parts, which are simpler and more fundamental. It is a philosophical position that complex systems are nothing but the sum of their parts, and that an account of a complex system can be reduced to accounts of its individual constituents. The lexical perspective to presupposition is *reductionist* in the sense that I begin with the assumption that there are no general, universal principles which govern the behavior of presuppositions. Instead, by looking at the smallest components of an expression- either words or morphemes- the overall presupposition behavior can be calculated based on the interactions of these small denominators.

triggers in such a way that (Zeevat's) anaphoric ones will accommodate in a single position, while (Zeevat's) lexical triggers can be accommodated in multiple locations. The assumption draws a close connection between the meaning of a word and the way in which that word interacts with the context, as well as other words which carry their own presuppositions. Essentially, *resolution becomes an intrinsic component of word meaning*, instead of some external set of guidelines put into action by some hypothetical overseer. With this point of view in mind, a word can be seen as being 'responsible' for its own presuppositions.

So far, I have singled out several aspects of a word's meaning with the explicit purpose of giving leeway to solving the problems listed in this Chapter. These include: The information necessary to determine whether two individuals are identical (for binding), or if they have bridging links; the constraints and preferences necessary to resolve the presuppositions that a word triggers. These aspects however, barely touch the core of our subject matter. What I think is the most important element of the meaning of a word, and what constitutes the semantic representation of a lexical entry, is *a set of referential functions in the form of discourse referents, and a list of all relevant discourse conditions attached to those referents, such that they ensure that the context update of the utterance must be both consistent and informative with respect to the meaning of the word as we understand it.* Consistency and informativity seem to be a recurring theme here, but these are merely the minimum criterion of any context update, and the only attributes that are common to *all* words. The contribution of individual words goes far beyond consistency and informativity. This point is perhaps made most succinctly by raising three intimately related questions: 1. What exactly is accommodated in the process of presupposition accommodation? 2. What exactly is 'interacting' in presupposition interaction, such as between the presuppositions in (58)? And 3. How do we build up a context so that the correct inferences about the discourse may be drawn from it? These are profound and difficult questions, and much to my own dismay, they cannot be answered to their full satisfaction either here or in the remainder of this dissertation. To even begin answering these questions however, we are left with nothing but the lexical approach I have proposed. Unless we embark on an endeavor that scrutinizes each and every lexical presupposition trigger, what their semantics consists of and how they behave in relation to context and each other, we will never be able to answer these questions. Consider the following (Kamp, 2001b):

(59) I gave the workers a generous tip. One thanked me. The other one left without saying a word.

The three interpretations for 'one' appearing in both the second and the third sentence of the above discourse are: 1. As a proper name of the first positive integer; 2. As the impersonal pronoun much like the German *Man*; 3. As an indefinite NP that requires anaphoric resolution from previous context. For the above discourse, the third interpretation will not only pick out from the set of workers (introduced by 'the workers') under the first sentence the appropriate referents for both occurrences of 'one', the latter 'one' will also interact with 'the other' in the third sentence to produce the inference that 'the workers' in the first sentence refers to a set consisting of exactly two workers. There is no way to figure out exactly how the interaction takes place, and how the inference would give us two workers, unless we have some means to compute the meaning contents of the words involved. There are a number of interactions in (59), and it would take an entire chapter for me to do full justice to them. The only point I intend to make here with this example remains the same as before: The study of presuppositions must eventually be rooted in a study of the individual word triggers. Until we become fully knowledgable of the conditions they impose on context and how they interact, we will never be able to fully predict their presuppositional behavior. *A generalized theory will never be sufficient. Only case studies can provide comprehensive coverage.*

As an ending disclaimer: I strongly caution that although one may be tempted by such a lexical perspective to assume that every presupposition triggering word will generate its own presuppositions, and that it does so in a way that is in principle independent from the ways in which other lexical presupposition triggers generate theirs- this is obviously *false*. I certainly do not deny that there are classes of presupposition triggers which share certain properties, or that there are features of presupposition behavior that the presuppositions have in common. Rather than taking it literally, the motivation behind the lexical perspective proposed in this Chapter should be seen as a clarion call to semanticists- the study of presuppositions ought to start from the basics: We must first draw up a syntax-semantic framework that is driven by individual lexical specifications to deal with the compositional integration of lexical information into context. This will provide the ground for observing presupposition and meaning interactions, while opening up a greater potential for world knowledge to play a part in DRT. From the studies of various lexical entries we may then induce a generalized theory that expands the current framework- on the one hand, we will be able to distinguish those properties of presuppositions which are unique to individual words or expressions, but also, on the other hand, those properties that are shared amongst sets of triggers, including those which are common to all presuppositions. It is those latter properties that can be seen as the essential part of a general theory of presuppositions.

Chapter 3

The Lexical Entry for the Definite Determiner

The most logical response to the repeated call for a lexically based look at presuppositions in the last chapter is to follow up with a simple, but nevertheless fundamentally crucial presupposition trigger as the subject of our case study. The primary goal of this chapter therefore, is to give a rigorous formulation of the operations involved in constructing semantic representations of sentences that contain the presupposition triggering determiner 'the'. To fully and accurately reflect the referential functions of a definite, there must first be a syntax-semantic interface to facilitate the computation of the existence and uniqueness presuppositions of the definite determiner, and then an algorithm to resolve these in various given context situations. Second, one of the key tasks in presupposition resolution is to demarcate a contextual domain in which the referent of the definite can be uniquely identified. In connection to this, it is important to distinguish between singular and plural definite descriptions.

Taking the lexical perspective that was argued for at the end of the last chapter, we assume that a resolution algorithm is encapsulated in the lexical entry of 'the', where lexical entries in general are designed to function under a broader syntax-semantic framework. The lexical entry of 'the' is to merge with entries from neighboring nodes on a generic Context Free Grammar (CFG) tree or similar syntactic structure (such as those assumed in HPSG, GPSG, LFG). The syntax-semantics interface adopted here was first outlined by Blackburn and Bos (1999), who based their proposal on the Compositional DRT (CDRT) of Zeevat (1989) and Muskens (1996). The semantic representations (of both words and complex expressions) are written with the notations outlined in a recent version of DRT that incorporates the handling of presuppositions (Kamp et al., 2008). Originally proposed by van der Sandt (1992), this version of DRT takes the view that presuppositions should generally be treated as anaphoric expressions. Taking this as a starting point, Krahmer and van Deemter (1998) elaborated the presupposition resolution algorithm for the case of definite NP's. In this chapter, we will try to refine their results in so far as they regard the definite determiner. The presupposition resolution algorithm that operates from within the lexical entry of 'the' and the appropriate syntax-semantic interface constitute the basis for arriving at a set of optimal semantic representations for sentences containing the definite determiner.

3.1 Syntax-Semantics Interface: the “Box + λ” Framework

Compositional semantics must rely on some syntactic theory for input. In this regard, traditional DRT (Kamp & Reyle, 1993) assumes a version of Generalized Phrase Structure Grammar (GPSG) (Gazdar, Klein, Pullum and Sag, 1985). I assume a similar syntax here, thus the trees I will be using should be thought of as generated by GPSG rules. These syntactic rules have much in common with the simple phrase structure rules seen in HPSG, LFG, etc, as well as with the categorial grammar used in Montague's Proper Treatment of Quantification in Ordinary English (PTQ) model (Montague, 1973), the last of which is homomorphic with the syntax-semantic interface we adopt throughout the course of this dissertation[1].

The semantic representations are written in the notation of an extended version of DRT that incorporates presuppositions (Kamp et al., 2008). The semantic representations, DRSs, are constructed in a similar fashion as in Blackburn and Bos' “Box + λ” framework (Blackburn & Bos, 1999), which is based on Compositional DRT (Muskens, 1996). (This framework was successfully implemented by Blackburn and Bos in Verbmobil (Bos, 1994)). The most succinct way to illustrate how semantic representations are built from a syntactic structure in the Box + λ framework is with an example. Given the following lexical entries:

[1]Lexical entries operate under a syntax-semantics interface. In this dissertation, we will not be focusing on any particular syntactic theory, but rather try to include some of the necessary elements that belong to any plausible syntax-semantic interface. The syntactic analysis I assume will simply incorporate sets of syntactic properties of analyzed sentences which any viable theory of syntax should make available in some form.

$$\text{a: } \lambda P' \, \lambda P \left(\boxed{\begin{array}{c} u_2 \\ \\ \\ \end{array}} \oplus P'(u_2) \oplus P(u_2) \right)$$

$$\text{John: } \lambda P \; \boxed{\begin{array}{c} u_1 \\ \\ \text{John}(u_1) \end{array}} \oplus P(u_1)$$

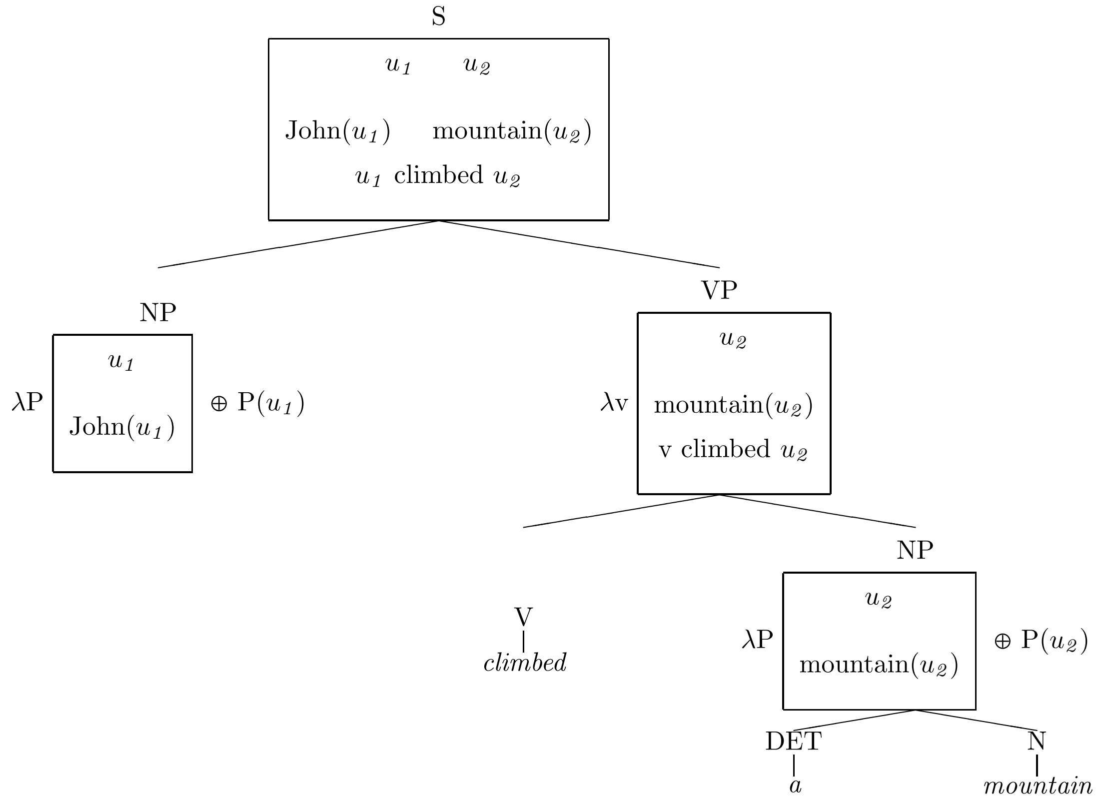
$$\text{mountain: } \lambda v \; \boxed{\begin{array}{c} \\ \\ \text{mountain(v)} \end{array}}$$

$$\text{climbed: } \lambda Q \lambda v \left(Q\left(\lambda v' \; \boxed{\begin{array}{c} \\ \\ \text{v climbed v}' \end{array}} \right)\right)$$

The construction of the semantic representation for (60a), a sentence presumably devoid of presuppositions, is displayed in (60b):

(60) a. John climbed a mountain.

b.



Let 'a@b' stand for 'a applied to b', (the β conversion, or β reduction rule of the Typed Lambda Calculus). Each time when two nodes on the tree unify, this happens via β conversion, followed by an application of DRS-merge $\oplus$. $\oplus$ is defined as follows:

Definition 10, DRS Merge Function, $\oplus$

> Let K_1 and K_2 be DRSs without presuppositions. $K_1 = \langle U_1, Con_1 \rangle$ and $K_2 = \langle U_2, Con_2 \rangle$. Then $K_1 \oplus K_2 = \langle U_1 \cup U_2, Con_1 \cup Con_2 \rangle$

Examples of the $\oplus$ function can be found in Bos (1994) and Blackburn and Bos (1999) (in Muskens (1996), it is written as ';', and called 'the sequencing operator').

More than one β conversion may be involved in a single unification. For instance, the way in which the DRS on the VP node of (60b) is derived as follows:

$$\lambda Q \lambda v\ (Q(\lambda v' \boxed{\begin{array}{c} \\ \\ \text{v climbed v}' \end{array}})) \ @\ \lambda P\ (\boxed{\begin{array}{c} u_2 \\ \\ \text{mountain}(u_2) \end{array}} \oplus P(u_2)), \text{ producing:}$$

$$\lambda v\ (\lambda P \boxed{\begin{array}{c} u_2 \\ \\ \text{mountain}(u_2) \end{array}} \oplus P(u_2)) \ @\ (\lambda v' \boxed{\begin{array}{c} \\ \\ \text{v climbed v}' \end{array}}),$$

This is followed by another β conversion:

$$\lambda v\ (\boxed{\begin{array}{c} u_2 \\ \\ \text{mountain}(u_2) \end{array}} \oplus \lambda v' \boxed{\begin{array}{c} \\ \\ \text{v climbed v}' \end{array}} \ @\ u_2),$$

$$\lambda v\ (\boxed{\begin{array}{c} u_2 \\ \\ \text{mountain}(u_2) \end{array}} \oplus \boxed{\begin{array}{c} \\ \\ \text{v climbed } u_2 \end{array}}),$$

After merging, we finally have the VP:

$$\lambda v \boxed{\begin{array}{c} u_2 \\ \\ \text{mountain}(u_2) \\ \text{v climbed } u_2 \end{array}}$$

In this framework, each node on the syntactic structure is annotated with a semantic representation, a DRS. The leaf nodes are lexical entries, each represented by a lambda DRS, and all nodes except the root are intermediate stages of the semantic construction. The result of this construction is a *Preliminary DRS*. The semantic representation for the entire sentence is represented in the root node, and it is arrived at by unifying the lambda DRS's of lexical entries, and then through further unification of Preliminary DRSs of neighboring intermediate nodes from the given syntactic structure in a *bottom-up* fashion. The root of (60b) is not only a Preliminary DRS, but also the *final DRS* representation for (60a). The reason for this is because there are no unresolved presuppositions in (60b), as there are no apparent presupposition triggers involved. A Preliminary DRS of a sentence *with* presupposition triggers on the other hand, will contain unresolved presuppositions at the end of the Box + λ construction. These presuppositions are dealt with during the semantic-pragmatic phase in which trigger-specific algorithms defined within the lexical entries of those triggers will guide and govern the resolution procedures.

Some of the key attributes of this particular framework which make it ideal for the current pursuit are: It is type-logical, transparent, bottom-up, compositional, and it allows for specification of lexical entries. I will refer to this framework in later sections as “Box + λ”.

3.2 Definite as Presupposition Trigger

We saw in the construction in (60b) of the DRS for (60a) that the indefinite determiner ‘a’ has the power to introduce new discourse referents. Consistent with the construction rule for indefinites in traditional DRT (CR.ID, Kamp & Reyle 1993, p.122), this capacity is specified in the lexical entry as part of the contribution of indefinites generally[2]. The same holds true for the proper name ‘John’, although we must bear in mind that this analogue is merely the result of simplification: *proper names too are presupposition triggers*, but their presuppositions are resolved following quite different principles. Instead of introducing a new discourse referent into the universe, proper names impose the presuppositional constraint that the entity be

[2]The construction rule in traditional DRT takes the syntactic structure of an indefinite NP as input. The construction introduces a new discourse referent with a condition that is the descriptive content of the indefinite noun.

identifiable in the context of utterance (if that is not the case, the proper name is accommodated in the global DRS). Adherents of a descriptivist theory of meaning such as Russell hold the view that proper names are concealed descriptions- that the meaning of a proper name is essentially a set of properties that belong to the individual that bears the name. This set of properties can be expressed as a complex description. An entity that satisfies this description will have all those properties and thus qualifies as the denotation of the name. According to this view then, names are just definite descriptions, and like definite descriptions, they are presuppositional in that they presuppose unique satisfaction of the sets of properties associated with them. (On a non-Russellian view of proper names, such as Kripke's, names are still presuppositional, but the presuppositions take a different form).

It was observed by Frege that a singular definite description 'the N' has two preconditions associated to its referential function: *There is at least one N*- a presupposition of N's non-emptiness; and *there is at most one N*- a presupposition that N is unique. These two presuppositions must be satisfied in order that the description can refer- otherwise the sentence containing the description will fail to have a proper truth value. According to van der Sandt (1992), 'the' is a presupposition trigger that instead of directly introducing the discourse referent, generates a presupposition, albeit one that makes it behave in much the same way as an anaphoric expression. It is obvious but important to note that in general, uniqueness must be understood as *uniqueness within some contextually restricted and salient domain*, this contextual domain is itself anaphoric to a set of entities which the interlocutors share in the common ground. Definite descriptions typically involve more descriptive content than pronouns; furthermore, the presuppositions connected with definite descriptions have the potential to accommodate in case a suitable antecedent cannot be found.

A short recap of the relevant bits in Chapter 1 seems appropriate here: According to van der Sandt (1992), the interpreter of a definite description should first seek to identify it with an antecedent in the existing context as it is available to him. This is done as follows: One begins by looking for an antecedent in the sub-DRS nearest to where the presupposition is triggered; if a suitable antecedent is not found there, the search is continued in the next nearest sub-DRS, and so on. If necessary, this process is repeated all the way up to the global DRS. When an antecedent is found, the discourse referent of the definite and its antecedent are identified. This process is called *binding*. If no suitable antecedent has been found anywhere, the presuppositional DRS triggered by the definite is inserted into the global context, or one of the non-global, sentence-internal contexts. This second process is called *presupposition accommodation*. Like binding, accommodation can, according to van der Sandt, take place at the global, the local, and some intermediate level. Global accommodation is when the presuppositional DRS is added to the global DRS, and this is the most preferred option. If global accommodation would produce an inconsistency, redundancy, or an unbound variable, then intermediate accommodation is resorted to, and when that also fails, local accommodation remains as the last option. Among the cases of intermediate accommodation are those where a presuppositional DRS triggered in the consequent of a conditional is added to the antecedent, or when a presupposition triggered in the nuclear scope of a quantifier is added to the quantifier's restrictor. Local accommodation of these presuppositions amounts to adding to the consequent or the nuclear scope itself.

That, however, is not the end of the story, and it was shown in Chapter 2 that van der Sandt's resolution guidelines are too general and insufficient for our needs- they apply across the board to all presuppositions, and constraints such as consistency, informativity, or the prevention of unbound variables during accommodation are not enough to account for where accommodation of different kinds of presuppositions can take place. What is needed instead, are algorithms which specify for each type of presupposition how presuppositions of that type can be resolved. In addition, we also need for each type of presupposition trigger a specification of how representations can be computed for the presuppositions that are generated by possible occurrences of triggers of that type. Here, we address these two problems for the special case of the presupposition trigger 'the'.

The construction of the representation of presuppositions triggered by 'the' is comparatively straightforward. However, as opposed to many other accounts of the semantics of definite descriptions, which deal exclusively with singular descriptions, we split the presupposition triggered by 'the' into two parts- an *existence presupposition* and a *maximality presupposition*, which says that the referent of a description includes the totality of what satisfies its descriptive content. These two presuppositions apply to both singular and plural definite descriptions. The distinction between them manifests itself in that (with a few exceptions I will ignore), the referents of singular descriptions are single individuals and those of plural descriptions sets of two or more individuals (or, in logical terminology, the referents of singular descriptions are *atomic* and those of plural descriptions, *non-atomic* individuals). In terms of satisfaction of the predicate (common noun phrase) with which the definite article combines to form the given definite description, the distinction between singular and plural descriptions is that between the requirement that the predicate be satisfied by a single (or atomic) individual, and that it be satisfied by more than one individual (or by a non-atomic individual). When these respective constraints are combined with the existence and maximality presupposition generated by 'the', then we get the unique satisfaction requirement for singular definite descriptions and the non-unique satisfaction requirement for the plural ones.

At this point, we assume a semantics for 'the' according to which the presupposition it triggers is *just* the existence presupposition. The presuppositional part of the semantics of 'the' consisting of existence and maximality presupposition, specifies the denotation of the descriptions as the non-empty totality (or mereological sum) of all satisfiers of the predicate with which 'the' combines. The grammatical number of the description, i.e. whether the description is singular or plural, then imposes the further constraint that this totality consists of one satisfier in the first case and more than one in the second.

Thus we arrive at the following entry for 'the', which covers both the case of singular and of plural definite descriptions:

Entry 1, 'the' for definite NPs:

$$\lambda \mathrm{P}'\ \lambda \mathrm{P}(\left\langle \underset{\text{Presuppositional DRS}}{\left\{\boxed{\begin{array}{c} u \\ \\ u = \Sigma\ u.\ \mathrm{P}'(u) \end{array}}\right\}}, \quad \underset{\text{Assertive Content}}{\boxed{\begin{array}{c} \\ \\ \end{array}}} \right\rangle \oplus \mathrm{P}(u))$$

Note that the presuppositional part of Entry 1 carries the existence presupposition that something satisfies the predicate P′. For if not, then there would not be anything represented by u.

When 'the' is combined with an actual number feature- singular or plural- then this feature adds a further presupposition: for 'singular', the referent u of the description must be a single element (it must be atomic); for 'plural', it must consists of more than one element (it must be non-atomic). Thus the semantics of 'the' + 'singular' is given by:

Entry 1, 'the' for *singular* definite NPs:

$$\lambda \mathrm{P}'\ \lambda \mathrm{P}(\left\langle \left\{\boxed{\begin{array}{c} u \\ \\ u = \Sigma\ u.\ \mathrm{P}'(u) \\ |u| = 1 \end{array}}\right\}, \boxed{\begin{array}{c} \\ \\ \end{array}} \right\rangle \oplus \mathrm{P}(u))$$

And likewise for plural descriptions:

Entry 1, ‘the’ for *plural* definite NPs:

$$\lambda \mathrm{P}'\ \lambda \mathrm{P}(\Big\langle \left\{ \begin{array}{|c|} \hline u \\ \\ u = \Sigma\ u.\ \mathrm{P}'(u) \\ |u| \geq 2 \\ \hline \end{array} \right\}, \begin{array}{|c|} \hline \quad \\ \\ \\ \hline \end{array} \Big\rangle \oplus \mathrm{P}(u))$$

The existence presupposition of the definite as found in Entry 1 is expressed using the ordered pair notation adopted for Preliminary DRSs (Kamp, et al., 2008). In this notation, representations of presuppositions are always left-adjoined to the representation of the assertive content of the sentence part in which those presuppositions are triggered. Moreover, presuppositions which are generated by other presuppositions are left-adjoined to the representations of those. This allows for presupposition nesting: presuppositions at a more deeply embedded level are more ‘fundamental’ in the sense that their resolution is a prerequisite for the truth conditions of those presuppositions to which they are left-adjoined, and therefore they must be resolved first. The source location of a presupposition trigger is ‘registered’ by left-adjoining the representations of presuppositions always to the DRS that represents the sentence part in which the presupposition is generated. This way, we keep track of the local origins of presuppositions, and so it is possible to recognize from the preliminary sentence DRS what is the local context of each represented presupposition (and what, if any, are its intermediate contexts).

The DRSs merge function in Definition 10 needs to be extended to cover cases when presuppositions are involved:

Definition 10′, DRS Merge Function for Preliminary DRSs, ⊕

Let $<\mathcal{K}_1, K_1>$, and $<\mathcal{K}_2, K_2>$ be Preliminary DRSs. K_1 and K_2 are DRSs, and $\mathcal{K}_1$ and $\mathcal{K}_2$ are sets of Preliminary DRSs. Then:

$<\mathcal{K}_1, K_1> \oplus <\mathcal{K}_2, K_2> = <\mathcal{K}_1 \cup \mathcal{K}_2, K_1 \oplus K_2>$

If there is a discourse referent in the discourse context of a definite description which may serve as an antecedent for the definite, then binding takes the form of identifying the antecedent referent with the discourse referent of the description (van der Sandt, 1992). When binding is not possible, 'the' requires accommodation, which takes the form of introducing the discourse referent of the description into some DRS universe accessible from the position of the description. We start with cases where one or more antecedents are found, to which the descriptions might be bound. Van der Sandt (1992) proposed some general guidelines for binding (Definition 9a), and these are further expanded by Krahmer and van Deemter specifically for the case of definite NPs (Krahmer & van Deemter 1998). I will first try to incorporate some of their solutions into the lexical entry for 'the', so that they can be implemented within the Box + λ framework, I will then look at some of its problems and make some further adjustments.

3.3 Finding an Antecedent

Resolution of the presuppositions of definite descriptions occurring in texts requires identifying a *suitable* discourse referent in the discourse context provided by the DRS of the part of the text preceding the description. The question regarding suitability reemerges here[3], and we will try to tackle this by looking at all the various types of relations that are possible between the presuppositional anaphor of the definite, and its potential antecedent in the discourse context.

The most fundamental requirement for an antecedent to be "suitable" is that it must satisfy the constraints imposed on u by P' in Entry 1. In van der Sant's

[3]Refer to the end of Chapter 1, section titled "DRT and the Anaphoric Treatment of Presuppositions", and the beginning of Chapter 2, "Suitability, and Partial Match", for previous discussions about suitability.

model, this requirement is met, presumably, by pairing the constraints imposed on the antecedent by the discourse context K_{dis} with the constraint P′. The P′ constraint on u and the constraints imposed on a potential antecedent y by K_{dis} can stand in a number of different reslations. These relations determine the degree to which y is suitable as antecedent for the given description. Some of these relations amount to what Krahmer and van Deemter call "partial match". As we have seen, when looking at the partial match examples presented in Chapter 2, the precise characteristics of these different relations is a non-trivial matter[4].

In this section, I will first outline the key criteria according to which partial matches are classified. This will be followed by an informal discussion of each type of partial match and how suitable potential antecedents are as binding candidate standing in the different partial match relations to the discourse referent representing the description.

So far, I have been talking about the constraint P′ that is imposed on the discourse referent u of the description under discussion. But what is P′ precisely? What I said about the architecture of Box + λ seems to provide an unequivocal answer to this question: It is handled by the descriptive content of the descriptive phrase which was combined with 'the' to form the definite description under consideration. But in fact, in general that is *not* the right answer. In general, P′ is the combination of the descriptive content of the description and some additional resolution- usually

[4]To his credit, van der Sandt also noted that the resolution algorithm should be able to generate all the consistent readings and then somehow rank them according to a certain preference:

> . . . The resulting set (of possible readings) is ranked by a preference order, which is determined by full versus partial matching, relative distance along its projection line, discourse principles, and non-linguistic knowledge. These factors then finally single out the preferred interpretation. A full discussion of the discourse factors that co-determine the choice of the preferred interpretation if the resolver leaves open a number of logical possibilities is beyond the scope of this paper (van der Sandt, 1992, p. 363).

As one can see, van der Sandt stopped short of spelling out in terms of what makes one reading more preferred over the other when partial match is involved. The resolution algorithm developed in this chapter is an attempt to fill this gap.

referred to as ‘domain restriction’ that is provided by the context (Westerståhl ,1984; von Fintel, 1994; Stanley & Szabo, 2000).

3.3.1 The Classification of Partial Match

The first stage when designing the resolution algorithm for the definite presupposition is to exhaustively examine all the different circumstances under which binding is possible. Binding is only possible when there is *at least one* potential antecedent in the discourse context, and only if there is at least some form of “partial match” between the antecedent and the description for which binding is to be found. A *potential antecedent* is defined to be any discourse referent in the context DRS relative to which the definite description is to be interpreted that is accessible from the position of the descriptions’s representation in the Preliminary DRS of the sentence.

The notion of “partial match” is one that has been tokened rather informally in the literature, it can mean anything from absence of a contradiction when anaphor and antecedent are identified (van der Sandt, 1992), to “intermediate degree of similarity between the two nouns” (Krahmer & van Deemter, 1998). The notions of partial match (and “full/no match”) need to be defined more precisely. In particular, it should be clear that these notions are relations between a given definite description, and any one of its potential antecedents.

Two considerations dominate our classification of partial match throughout this chapter- the semantic *value* and the *form*, of the anaphor on the one hand, and of its potential antecedent on the other. Although these two are not independent from each other, match relations defined in terms of them, i.e. form-based relations and value-based relations reflect very different perspectives in the nature of the anaphoric relation. According to the ***value-based*** perspective, there is a partial match between the definite anaphor and a potential antecedent when the constituents associated with them permit overlap of their extensions. To put this in more formal terms, I borrow the notion of *Value Set* from Krahmer and van Deemter (1998, p. 16). A

"Value Set", VAL, for a discourse referent x that appears in a DRS K is defined as follows:

Definition 11, Value Set VAL

VAL(x, $[\![K]\!]_{M,f}$) $=_{def}$ $\{$d $\in$ D | M $\vDash_{f \cup <x,d>}$ $K\}$, where f is an assignment function that assigns values to the free discourse referents in K.

A Value Set is the set of all values that x can take on in M such that K is satisfied. For a unary predicate P, the value set VAL(x, $[\![$P(x)$]\!]$) is the same as the predicate denotation $[\![$P(x)$]\!]$. In cases where x is an argument of a non-unary predicate Q in K, f will assign values to the other arguments such that Q is satisfied. To illustrate with an example, the indefinite description "a man wearing a brown hat" introduces a discourse referent y, such that its Value Set is:

VAL(y, $[\![[y, z\ |$man(y), brown hat(z), wear$(y, z)]]\!]_{M,f}$) =
$\{d \in D \mid d \in I(man)\ \&\ \exists d' \in D(d' \in I(brown.hat)\ \&\ <d, d'> \in I(wear)\}$.

The notions of Partial, Full, and No Match between a definite anaphor x and a potential antecedent y in a DRS K, according to the value-based approach, can be defined as follows[5]:

Definition 12, Partial, Full, and No Match: Value-Based Approach

Let $\mathcal{M}$ be the set of Models s.t. for every M $\in \mathcal{M}$, M is consistent with the world (and linguistic) knowledge of the interlocutors.

[5]From this point onward I will capitalize the first letter of these different types of matches when referring to them in the sense specified in these definitions. I will use lowercase letters when I use these terms more generally, or in the loose sense in which they are employed in much of the literature on the same topic.

There is a Full Match iff for every M $\in \mathcal{M}$,
VAL(x, $[\![K]\!]_{M,f}$) = VAL(y, $[\![K]\!]_{M,f}$),

There is No Match iff for every M $\in \mathcal{M}$,
VAL(x, $[\![K]\!]_{M,f}$) $\cap$ VAL(y, $[\![K]\!]_{M,f}$) = $\varnothing$,

There is a Partial Match iff for *some* M $\in \mathcal{M}$,
VAL(x, $[\![K]\!]_{M,f}$) $\cap$ VAL(y, $[\![K]\!]_{M,f}$) $\neq \varnothing$,

Both Full Match and No Match are relatively straightforward: If the potential antecedent and the anaphor are co-referential in all the models consistent with the world we know, then we have a Full Match; And if the antecedent and anaphor are necessarily incompatible in every model (i.e. their Value Sets have an empty intersection), then there is No Match between them. Partial Match can take a number of different forms. The generalization in Definition 12 for Partial Match can be expounded by listing all (three) of the possible set relations between the Value Sets of the definite anaphor x and its potential antecedent y. These set relations can also be explained in terms of entailment: Let 'the N' be the definite description for which an antecedent is being sought. Let x be the discourse referent introduced to represent the description and let K_N be the DRS which ascribes to x the descriptive content defined by N. Suppose that y is a potential antecedent for the description and that the discourse context specifies for y a conjunction of conditions $\phi(y)$. We consider the following three types of value-based Partial Match relations between y and x:

Definition 13, the Three Types of Partial Matches: Value-Based Approach

Type 1. The Antecedent is More Informative than the Anaphor:
For all Models M $\in \mathcal{M}$,
VAL(y, $[\![\phi(y)]\!]_{M,f}$) $\subseteq$ VAL(x, $[\![K_N]\!]_{M,f}$),
while for some M $\in \mathcal{M}$,

$\mathrm{VAL}(x, [\![K_N]\!]_{M,f}) \nsubseteq \mathrm{VAL}(y, [\![\phi(y)]\!]_{M,f})$,
or equivalently, $\phi(x) \vDash K_N$, but *not* $K_N \vDash \phi(x)$

Type 2. The Anaphor is More Informative than the Antecedent:
For all Models $\mathrm{M} \in \mathcal{M}$,
$\mathrm{VAL}(x, [\![K]\!]_{M,f}) \subseteq \mathrm{VAL}(y, [\![\phi(y)]\!]_{M,f})$,
while for some $\mathrm{M} \in \mathcal{M}$,
$\mathrm{VAL}(y, [\![\phi(y)]\!]_{M,f}) \nsubseteq \mathrm{VAL}(x, [\![K_N]\!]_{M,f})$,
or $K_N \vDash \phi(x)$, but *not* $\phi(x) \vDash K_N$

Type 3. The Anaphor and the Antecedent 'Overlap':
There is a Model $\mathrm{M} \in \mathcal{M}$ s.t.
$\mathrm{VAL}(x, [\![K_N]\!]_{M,f}) \cap \mathrm{VAL}(y, [\![\phi(y)]\!]_{M,f}) \neq \varnothing$,
and there is a Model $\mathrm{M} \in \mathcal{M}$ s.t.
$\mathrm{VAL}(y, [\![\phi(y)]\!]_{M,f}) \nsubseteq \mathrm{VAL}(x, [\![K_N]\!]_{M,f})$,
and there is a Model $\mathrm{M} \in \mathcal{M}$ s.t.
$\mathrm{VAL}(x, [\![K_N]\!]_{M,f}) \nsubseteq \mathrm{VAL}(y, [\![\phi(y)]\!]_{M,f})$,
or $\phi(x) \nvDash K_N$, $\phi(x) \nvDash \neg K_N$ and $K_N \nvDash \phi(x)$

The form of these definitions still depends on the choice of ϕ. The most natural choice appears to be that which identifies ϕ with the constraints that are imposed on y by the noun phrase on account of which y was introduced into the context representation (in other words, ϕ is determined in a similar way as the DRS K_N containing the discourse referent x representing the referent of the description 'the N'). From now on, we will assume that the candidate antecedent y have all been introduced into the context by NPs and that ϕ is determined in the way just indicated.

Under the value-based perspective, there are exactly three possible types of Partial Match. Type 1 is when the Value Set of the potential antecedent is subsumed by the Value Set of the anaphor. In other words, the antecedent is entailed by the anaphor or that the antecedent is *more informative* (e.g. "a man wearing a brown hat…the man...”). Type 2 is exactly the other way around. The Value Set of the anaphor is subsumed by that of the antecedent. In other words the anaphor is more informative, and in the event that it is bound to the antecedent, it actually adds information to it (e.g. “a man...the man wearing the brown hat...”). What this entails is that some form of accommodation has taken place implicitly, because the Value Set determined by the descriptive content of the antecedent is now restricted to a smaller Value Set than it was before resolution took place. We will see a full spectrum of examples in the next subsection. Type 3 is a rather special kind of partial match in the sense that it does not occur very often in day to day usage, and when it does, it usually involves plurals. Type 3 is when neither the anaphor nor the antecedent entails the other, but do not exclude each other either. Some examples include: “John has sons, the young children...”, “A lot of athletes came to the game, the Asians...”[6].

A number of linguists have used the word “compatible” to describe any of these three types of Partial Matches (e.g. van der Sandt, 1992; Beaver, 2001; Beaver, 2002; Krahmer & van Deemter, 1998). “Compatibility” too, is a relation between conditions associated with the anaphor and conditions associated with its antecedent. There are different degrees of compatibility. According to Krahmer and van Deemter for example, two discourse conditions have the highest degree of compatibility when the antecedent and the anaphor they predicate are mapped onto the same set of entities, that is, when conditions attached to the two discourse referents render them necessarily coreferential: Anything in any model that satisfies one set of conditions must also satisfy the other set. Thus the highest degree of compatibility is equivalent to Full Match in our terminology. Full Match obtains when the NPs of the anaphor and

[6] It is a matter of speculation as to why people very sparingly use a definite to refer back to something in context in the form presented in Partial Match Type 3. One possibility for this is perhaps explained by Grice (1975), according to which one must be as informative as required, but not more informative than necessary. When a speaker intends to use a definite anaphorically, Grician Maxim of Quality can be seen as a preference for a definite utterance that results in a Full Match, and when that is impossible, either Type 1 or Type 2, rather than Type 3, since Type 3 is more ambiguous than the other two. Speech production goes beyond the scope of this chapter and I will leave it at that.

its antecedent are identical ('a fat man' followed by 'the fat man'), but synonyms also yield Full Match, and so do a word and its dictionary definition[7]. The lowest degree of compatibility (viz. *incompatibility*), on the other hand, would be for example, when 'a man' is considered as potential antecedent for 'the woman', as 'man' and 'woman' are mutually exclusive in all models consistent with the world we know ($\mathcal{M}$). Partial match falls anywhere within the area intermediate between those two extremes. This is very common: In particular, it is the standard situation for anaphoric pronouns, e.g. 'the King of France' is a partial match antecedent for the male pronoun 'he'. But it is common in connection with definite description as well, e.g. 'Louis XVI' is a partial match antecedent for 'the King of France', given that in all models compatible with the world as we know, it is by all means possible that Louis XVI is the King of France.

Before we move on to some examples of Partial Match, there is another component of our taxonomy that needs to be made explicit. It was mentioned in the very beginning of this section that two considerations dictate our classification of partial match, and that the resolution strategies are dependent on the classification. So far we have only discussed the value-based approach. This is the more prevalent perspective in the formal semantics tradition. But the other consideration, which I call the ***form-based approach***, is important too. In this approach, matching of the anaphor with an antecedent is based on the *form* of their respective NPs. Antecedent selection according to the formal approach proceeds by comparing the form of the given description with that of the NP responsible for introducing the antecedent candidate y. There are two

[7] A thing to be said about intensionality here is that when the NPs of an anaphor and a potential antecedent are identical, they necessarily refer to the same set of entities in all worlds. However, since we are only concerned about worlds in which things conform to our general knowledge and our language conventions, those worlds where synonyms are not coreferential, or where dictionary definitions fail to apply are automatically ruled out. For example, models in which the word 'man' denotes the set of adult human males but 'guy' denotes the set of cardboard boxes play no part in our consideration (they are never part of the common ground). Krahmer and van Deemter use the notion of "Hearer Models" (H-Models) to refer to a class of Models that are "in accordance with the interpreter's view on the common ground" (Krahmer & van Deemter, 1998).

manifestations the approach can take. The first arises when the anaphoric description is of the form ‘the N’, where N is a simple noun. In this case, the method consists in comparing N with head noun N′ of the noun phrase responsible for introducing y. The second version arises when the ‘N’ of ‘the N’ is not a simple noun, but a complex NP, consisting of a head noun with a prenominal adjective, a relative clause, and/or a prepositional adjunct. In this case, the comparison involves not only the head noun of N, but also its other parts.

The strongest (and most common) kind of form-based match is a (form-based) Full Match in which the expression that are being compared are identical. This kind of match is straightforwardly verified. When N is a simple noun, form-based matching may also take a weaker form than value-based Full Match (i.e. identity with the head noun N′ of the noun phrase that introduced the antecedent). For instance, N can be a well known synonym of N′ or N′ can be a hyponym of N. When N is a complex phrase, value-based matching procedures others than formal identity may occasionally play a role as well; but such procedure will not be considered here.

Form-based Full Match can be understood as a special kind of *lexical givenness* (Baumann/Riester, 2010). A referential expression is lexically given if there is either an identical expression, a synonym, or a hyponym within the preceding discourse that acts as lexical head of the phrase that may serve as its antecedent. A form-based Full Match is obtained when this lexical head is identical with the lexical head of the anaphoric description. What can the form-based approach contribute to antecedent selection and how can it interact with the value-based approach? I assume that from a logical point of view the form-based approach plays a role that is secondary to the value-based method. It is only in cases where several competing antecedents are present in the context DRS, and every one of them has the same type of Value Set relation with the anaphor. In such situations, there is simply no way to assign preference to the antecedents solely on a value-based classification, the form-based method then often comes to the rescue, selecting one among the antecedent candidates that are still remaining via, for instance, head noun identity.

It is important, however, to distinguish between the secondary logical status that is attributed to the form-based approach by this description of its function and its psychological importance. In particular, head noun matching acts as an extremely important cue to co-reference in texts, and it makes it easy for readers to zero in on the intended antecedent of an anaphoric description also in cases where the selected antecedent is unequivocally selected by the value-based method (as in "a man and a woman entered the room. The man was carrying an umbrella"). We will see some more examples of this in the following sections. There will also be a data related discussion about the roles of form-based and value-based selection towards the end of this chapter. Experiments have been done with regard to definite use. The results of which suggest that the form-based approach plays a far bigger role in resolution than was previously believed, and that certain measures such as *recency* and *segmentation* could be built into a form-based approach to improve the accuracy of a resolution algorithm.

The role we have determined for the form-based approach is a secondary one. But is that really the case? While it remains necessary to look at more examples, a partial answer could be provided here towards that end: Unlike the value-based approach, a form-based analysis *cannot* be used to classify the full spectrum of possibilities. For example, the notion of Partial Match cannot be defined consistently by merely matching the descriptive contents of the candidates. They can only be derived when the form-based approach functions in conjunction with the value-based approach. The reason for this is that even if some of the descriptive contents of the anaphoric description overlap with those of a potential antecedent, it is still perfectly possible that they have No Match in the value-based analysis, and therefore constitute a contradiction. Take for example, 'A house on the left' and 'the house on the right', judging from their form alone- since they share the same head noun- there appears to be some form of partial match. But in reality, these two are No Match according to the value-based analysis, and they should not be allowed to bind because their descriptive contents contradict one another. So even though the value-based classification is insufficient and leaves us with an ambiguity sometimes, the form-based classification alone would simply yield the wrong results. For this reason, we will in discussing the examples to which much of the remainder of the chapter is devoted, continue to structure the discussions as we have already begun to do. The primary consideration will be the value-based approach, and the form-based approach will play the part of 'deputy', who is called upon only when the value-based approach does not deliver a verdict on its own.

3.3.2 Full Match

A full list of possible matches between the definite anaphor and its potential antecedent can be found in the subsequent subsections. To set us on the right foot with a small recap of our methodology: If we assume van der Sandt is correct in claiming that binding is preferred over accommodation, then the task of designing a presupposition resolution algorithm for the definite is to first survey all of the possible combinations between the anaphor and its potential antecedent. We have already specified the two criteria which are used to classify those combinations, these are known as the value-based and the form-based approach. The next task is to see for each and every type of Full/Partial Match the kind of binding behavior they exhibit, whether one binding reading is more preferred over another, or if none of the available antecedent qualifies, and accommodation is preferred. The binding algorithm can be viewed as a summary of the correlations between each class of anaphor-antecedent combination with a specific set of resolution preferences.

The first benchmark for binding (as opposed to accommodation) is a *Full Match*. There are two notions of Full Match, the value-based, and the form-based Full Match. Either one of these is a sufficient condition to licence binding. In fact, it is not difficult to see that the form-based Full Match automatically entails the value-based one, since if the NPs are identical (with the exception of their determiners), then they must have the same value set. This, however, is not the case the other way round, a value-based Full Match does *not* necessarily entail a form-based Full Match (think of synonyms).

Among these two types of Full Match, an antecedent for which there is a form-based Full Match with the anaphor should always be preferred as the binding candidate over another antecedent in the same context that obtains *only* a value-based Full Match. This claim is consistent with Krahmer and van Deemter's argument (1998) that we should prioritize binding with antecedents that have fully matching descriptive contents/discourse conditions above all other relations (such as partial match). Let's look at some examples before theorizing any further:

Full Match:

(61) a. Yesterday, an uncle of mine bumped into a man. The man fell to the ground.

b. Yesterday, a man bumped into an uncle of mine. The man fell to the ground. (Krahmer & van Deemter, 1998, p. 15)

c. Yesterday, a guy bumped into a man. The man fell to the ground.

d. Yesterday, a man bumped into a guy. The man fell to the ground.

e. Yesterday, a man hit an uncle of mine on the back. The man fell to the ground.

f. Yesterday, John bumped into a guy. He was really hurt and the man took him to the hospital.

g. Yesterday, Jean bumped into a guy. He was really hurt and the man took him to the hospital.

All of the examples in this chapter, unless otherwise indicated, should be read on a *purely textual* basis, that is, pragmatic factors are to be excluded. Factors such as: Focus articulation, or the assumption that the speaker is pointing with his finger at a particular man when uttering any of the sentences in (61), the latter is known as *gestural deixis* (Levinson, 1983; 2004).

It seems that for both (61a) and (61b) it is strongly preferred that the definite 'the man' bind with 'a man', even in the face of the fact that 'an uncle of mine' must be a man as well. The order in which the antecedents are introduced, hence discourse topicality or salience, seems to play no role here. Similarly for (61c) and (61d), even though 'guy' has the same Value Set as as 'man' (they are synonymous), there is a strong tendency for 'the man' to be identified with 'a man', and not 'a guy'. This preference is so strong that neither of the sentences appears to be ambiguous. The penchant to bind to the antecedent with the same head noun is so strong that it even overwrites inferences-based preferences, as seen in (61e). Common-sensically, a man is far more likely to fall over as a result of being punched than fall over as a result of punching somebody. If we bind 'a man' to 'the man' in (61e), then this reading entails the contrary- the man who punched my uncle is the one who fell. The consequence of this is that the hearer is stuck with the burden to rationalize why he fell in order to make full sense of this reading (e.g. perhaps the man was a midget, or he tripped on a banana peel as he was hitting the uncle, etc). And despite that, binding 'a man' with 'the man' is still preferred over 'an uncle'. From these examples we learn that the resolution algorithm should not only take the accessibility or the value of the relevant discourse referents into consideration, but *binding with the antecedent that has a form-based Full Match should always be prioritized above all other alternatives.*

There is more to form-based matching than simply seeking an antecedent with the same head noun. Form-based full match for compound nouns, or nouns with modifiers pose a certain level of complication. In addition, discourse information must be made sensitive to the descriptive content by means of which the referents are introduced, a point that was also raised in Groenendijk, Stokhof & Veltman (1995). We will illustrate this latter point first. To avoid digression, let us take an example where pronouns are already taken care of through means other than a lexical based resolution algorithm. Consider (61f). First we decide that John is the topic, or the backward looking center of the second sentence, with the help of Centering (Grosz, Joshi & Weinstein, 1995; Walker, Joshi & Prince, 1998), and therefore the preferred antecedent for the pronoun of the second sentence. In the process of such pronoun resolution, the condition 'male' is introduced into the DRS, predicating the referent of 'John'. This stipulation is justified by the world knowledge that individuals named John are always male, and being male is a necessary condition to bind that person to the masculine pronoun. However, simply because we have 'John(j)' and 'male(j)' in the DRS now does not mean we should bind 'the man' in the second sentence to the discourse referent of John based on the compatibility of these discourse conditions. On the one hand this is a violation of Binding Theory (nonreflexive pronoun bound by a preceding argument of the same verb), but also because the condition 'male(j)' was *not* introduced at the time when the discourse referent j was introduced, but rather emerged at a later stage of the pronoun resolution phase of the second sentence- a piece of world knowledge brought to the foreground because pronoun resolution necessitates it. Likewise for (61g), where 'Jean', a gender neutral name, only is recognized as the name of a man when it is identified with the pronoun 'he'. 'Jean' too, is unavailable as an antecedent for 'the man' in the second sentence. It is therefore important to register the point when a discourse condition is introduced, and *the manner* in which it is introduced- is it introduced because the utterance specifies the condition in its head noun or by some other part of the introductory expression, during the syntax-semantic construction? Or is it introduced through inferences based on world knowledge, in order to facilitate the resolution of other anaphora during the semantic-pragmatic phase (as in (61f) and (61g))?

Under the form-based approach, only those nominal conditions which are *introduced simultaneously* with a potential antecedent are considered. This conclusion entails that the interpreter must remember how a referent is introduced into the discourse universe. Several empirical studies reinforce this intuition. Bates, Masling, and Kintsch (1978) points out that when the function of an utterance is to introduce a new discourse referent, the hearer's literal memory tends to improve. Jarvella and Herman (1972) have shown that listeners are good at recalling antecedents within the last sentence they heard, and less so as the antecedent becomes less recent. Vieria and Poesio (2000) shows that the hearer's window of memory for a potential antecedent is specifically between four up to eight sentences. In their studies, head nouns are matched before any further constraints are added.

The form-based Full Match between an anaphor and a potential antecedent can thus be formulated as the strict identity relation between the nominal conditions of the definite and those conditions which are introduced together with the anaphor. These are the discourse conditions reflecting the descriptive content of their *head nouns*. However, if they are compound nouns, or if they are modified by adjuncts or relative clauses, then the form-based approach must match all of the conditions associated with their NP modifiers as well. Exactly how Full Match should be defined in such cases is, however, a non-trivial question. Word-for-word match is readily defined, but we would also like for our definites to allow for small variations, such as the use of synonyms or changes in word order that do not affect meaning. Take the following examples:

(62) a. A: If you want to send something, there is a post office down the road.

B: Okay, I am going to first head over to the office where I left the post, pick it up and then go there as soon as possible.

b. A jolly good fellow walked into a bar and sat down next to a grumpy old man. The man spoke…

c. A jolly good fellow walked into a bar and sat down next to a grumpy old man. The man who was in a real good mood spoke…

There are three conventional forms of compound nouns typically found in English dictionaries- closed (e.g. barmaid, bedroom), hyphenated (e.g. editor-in-chief, air-brake), and open form (e.g. attorney general, fish tank). We will consider the one that is most prone to confusion. Head noun matching just isn't partial matching of head nouns one or both of which are compounds. 'Post office', and 'office' are different nouns, and there isn't even a temptation for an interpreter to take the partial morphological overlap between them as a reason for thinking they might be anaphorically linked. To the contrary, often as we normally understand, the word 'office' is not the same as 'post office'. The correct analysis of compound nouns should be part of any rigorously defined DRT syntax-semantics interface, and this is what we assume here. (62b) follows the same principle that was utilized in (61a)-

(61e), by matching of head nouns we get the correct reading for 'the man'. But this stops as soon as we look at (62c), head noun matching would yield the unintuitive reading which entails that the grumpy old man is in a real good mood. The reason is clear in this case: The relative clause of the definite description 'the man who was in a real good mood' is entailed by the information provided by 'a jolly good fellow' but incompatible with that provided by 'a grumpy old man': Incompability is an entailment-based relation that rules out a candidate antecedent no matter what. So the interpreter of the 'the man who was in a real good mood' is left with no other options than taking it as anaphoric to 'a jolly good fellow'[8].

It is clear from these examples that the value-based approach is more reliable because by definition it has a safeguard against inconsistent bindings. The form-based approach does not, and therefore should be applied *after* the value-based analysis to deal with ambiguities where two or more potential antecedents are present with the same type of Partial Match as the anaphor (and same distance on the accessibility path). And if things do come down to this point, the form-based approach should have the final verdict. In any case, when there is a Full Match by either standards, accommodation cannot occur.

[8]A thing to be said about word order. Most of the time it does not matter when modifiers of a noun are arranged differently, e.g. 'a jolly good fellow' has the same meaning as 'the good jolly fellow', and they are expected to bind in most if not every context. However, there are a few deviants where the ordering of the modifiers changes the meaning of an NP completely, e.g. 'a great white shark', which is not the same as 'the white great shark'. The former refers to a specific species of sharks, and the latter simply describes the color and size of a generic shark. But these are exceptions rather than the rule, and their occurrences vary from language to language. For those reasons, I will overlook the ordering of noun modifiers.

3.3.3 When the Antecedent is More Informative than the Anaphor

A spectrum of possibilities opens up when we fail to obtain Full Match- incompatible cases set aside, there is a variety of possible partial matches. Unlike Full Match, Partial Match cases are not classified based on form, but rather, we classify them according to the Value Set relation between the definite anaphor and its potential antecedent. According to Definition 12: *If the Value Sets are neither completely overlapping nor mutually disjoint, then we have some kind of Partial Match.* According to Definition 13, there are primarily three types of partial match phenomena. Examples from each type and an explanation of their properties are described in this and the following subsections.

Value-Based Partial Match, Type 1:

(63) a. If John has an oriental girlfriend, *his* girlfriend won't be happy. (van der Sandt, 1992, p. 350; Krahmer & van Deemter, 1998, p. 7)

b. If John has an oriental girlfriend, the girlfriend won't be happy.

c. If John buys a couple of Siamese cats, the pets won't be happy. (Krahmer & van Deemter, 1998, p. 6)

d. If John buys a Siamese cat, the pet won't be happy.

e. If John saw a Siamese cat, the pet won't be happy.

f. If John saw a Siamese cat, the critter won't be happy.

Krahmer and van Deemter set up their examples in the form of conditionals to highlight the dilemma between choosing binding and accommodation, as well as the choice of where accommodation should take place (since binding always takes place in the scope of the antecedent). These dilemmas originate from the fact that apart from the global DRS, the antecedent context can also be used as the context of interpretation for the definite anaphor that is triggered in the consequent. We begin with a familiar example, (63a), which was used by van der Sandt (1992). It involves the possessive rather than the definite as the presupposition trigger. Nevertheless, the partial match set up here is such that the conditions associated with the descriptive content of the antecedent entail that of the anaphor- if x is an oriental girlfriend then x is a girlfriend. The denotation of 'oriental girlfriend' is subsumed by the denotation of 'girlfriend', in other words, the antecedent is 'more informative' than the anaphor (Krahmer & van Deemter, 1998, p. 7). For me, there is a strong intuition that the global accommodation reading is the most preferred one for (63a): "John has a girlfriend. If he has an oriental girlfriend as well, his girlfriend won't be happy". However, van der Sandt's algorithm predicts binding; interestingly, his own intuition is that a sentence like this is genuinely ambiguous, and that neither reading is preferred (van der Sandt, *ibid.*). This view is somewhat reinforced by the fact that if we replace the possessive with a definite description, as in (63b), intuition suddenly reverses its course- here it seems that binding is more preferred- 'the girlfriend' refers to the oriental girlfriend of John in the antecedent. There appears to be no particular correlation between the resolution strategy and the type of partial match we are dealing with.

Van der Sandt's example poses several difficulties to our purpose. One of them comes from the lexical ambiguity of 'girlfriend'- this particular word could be meant in the sense of *a mistress*, or *a female friend*, which makes accommodation preferred in (63a) and (63b), or it could mean *a companion in life*, in which case binding is preferred. But more importantly, these examples conveniently disguise the fact that 'girlfriend' belongs to a broader class of nouns known as *relational nouns*, where a certain relation is inherent in the meaning of the (head) noun: This could be a part-whole relation (e.g. tail, roof); social/kinship relation (e.g. girlfriend, brother); or certain functional relation (e.g. president, department), etc. Through such relations, the noun (e.g. girlfriend) must always be associated to some other individual (or individuals) in the context (e.g. John). As non-anaphoric definite NP's (discourse-new use of the definite), this class of nouns usually appear in the form of possessive or genitive constructions (e.g. the girlfriend of John), so that the relation is made explicit. This is the reason why it is quite hard to make sense of (63b)- as soon as the possessive is removed, it becomes unclear whether 'the girlfriend' is used to refer to *John's* girlfriend, which binds it to his oriental girlfriend, or *somebody else's* girlfriend, which is also a possible reading (although the chances are slim, and very much depends on the contextual domain being considered). An accommodation reading for (63b) would leave the necessary link to a certain boyfriend underspecified. A cooperative hearer will be forced to to try to establish this link without guidance from the explicit context, by choosing what appears to her (for whatever reason) the most plausible candidate (presumably John, in this case), and *this* is the reason why (63b) has a preference for binding. It has *nothing* to do with partial match.

To avoid those problems caused by (63a) and (63b), Krahmer and van Deemter use the sentence in (63c) to illustrate the type of partial match where the antecedent is more informative than the anaphor. They predict that (63c) should be ambiguous between a global accommodation reading: "There is a set of pets$_1$, and if John buys a couple of Siamese cats$_2$, then they$_1$ will not be happy", and a non-projection reading: "If John buys a couple of Siamese cats$_1$, they$_1$ will not be happy". In spite of that, there are several issues involved in this example which I think should not be confused. First, there is the complication introduced by the plural. Krahmer and van Deemter's example here is somewhat contrived and is unhelpful to what we are trying to accomplish (to correlate various types of Partial Matches with certain resolution strategies) because there are exactly *two cats* by virtue of the 'couple' in (63c). Since there are only two cats, the only way for the plural definite to bind is to identify the set of pets with the set of two Siamese cats. In general, Partial Match between a plural anaphor and a plural antecedent should have another binding reading available, and this is the reading where the anaphor is identified to only a *subset* of its antecedent (e.g. (73c)). The second consideration is form-based- what kind of role does the head noun play in resolution of this particular type of Partial Match? And third, what actually determines the type of Partial Match in these examples of (63) is the set relation between the Value Sets of the definite and its antecedent. How does this type of Partial Match correlate with any of the resolution strategies? What kind of insights can we gain by a value-based classification? These are three different issues that must be discussed separately.

We will set plurals aside for the moment and consider (63d), a proximate clone of (63c), except that now we are dealing with singular NPs. This sentence exhibits a very strong preference for binding over global accommodation. Thus, the fog of ambiguity Krahmer and van Deemter insisted on is suddenly dispelled, all while we have succeeded in preserving the kind of Partial Match that (63c) was originally intended to illustrate[9].

There is also another problem that has to do with world knowledge inference which sometimes affect resolution. (63c) and (63d) are suggestive of the inference that "if someone buys a cat, then that cat becomes that person's pet". If we allow this inference, then binding seems to me very strongly preferred[10]. For this reason, let us replace the 'buy' with something else for a moment, something which is "neutral" enough that it does not suggest an inference or bridging link that will bias our judgement about the resolution of the definite presupposition. Take (63e) for example,

[9]The type of Partial Match we are dealing with and having had preserved in (63d) can be spelled out. Let $K_{(63d)}$ be:

$$\boxed{\begin{array}{c} \text{j} \quad \text{x} \\ \boxed{\begin{array}{c}\text{Siamese-cat(x)}\\ \text{buys(j, x)}\end{array}} \Rightarrow \boxed{\begin{array}{c} \partial \ \boxed{\begin{array}{c} \text{y} \\ \text{pet(y)}\end{array}} \\ \text{won't-be-happy(y)}\end{array}} \end{array}}$$

The value-based Partial Match type is thus: VAL(Siamese-cat(x), $[\![K_{(63d)}]\!]_{M,f}$) $\subset$ VAL(pet(y), $[\![K_{(63d)}]\!]_{M,f}$); colloquially, this translates to when the antecedent is more informative than the anaphor.

[10]To a certain extent this is also a problem when we pick examples like those in (63a) and (63b). If the interlocutors accept into their common ground that "if someone has, or gets a girlfriend, then any other girlfriends he already has will become jealous and unhappy", then (63a) and (63b) ought to both obtain the global accommodation reading.

there is no obvious inference one could draw from ‘seeing/saw’ which will affect the interpretation of the definite in the examples we have chosen. Binding *is* preferred in (63e), and van der Sandt’s algorithm yields the correct prediction for (63). The same is true for (63f), when we remove ‘the pet’ and replace it with a more generic ‘the critter’.

It is absolutely critical to set up the examples correctly if we want to discover anything meaningful about the relationship between resolution behavior and the way in which Partial Matches are categorized. This means if we want to come up with a theory about how resolution preferences are affected by the *value* and *form* of the ananphor-antecedent relations, then we must be very careful about choosing our examples. In particular, we must guard against unwanted interference from inadvertent bridging inferences. Several other measures must be taken to produce the most revealing examples. First, the way in which “if-then” statements are set up could prejudice our interpretation, since conditional constructions necessitate binding due to the kind of cause-and-effect relation that such constructions tend to suggest. In fact, I recommend that we should do away with “if-then” constructions altogether. The lack of competing antecedents in the discourse context makes that they can be used to illustrate only the alternative between binding and accommodation. An isolated antecedent in context carries a strong preference for binding (the only alternative being accommodation), since pronominal satisfaction is the preferred strategy for a speaker in such situations. Because of this complication, it is not easy to have from such examples what we want to know about binding. What we really need is a variety of Partial Matches, both in value and in form, in order to see which one of them the anaphor picks up as the most suitable binding candidate[11]. The first example illustrates a point that was made in the last section, namely that whenever the value-based analysis cannot determine the most preferred antecedent to bind to, then the form-based analysis gets to decide. In the case of Partial Matches, a bind-

[11] Another measure that has been implicit in our examples is that all of the potential antecedents being considered must have the same distance on the accessibility path to the definite anaphor. This is a very basic premise and there is nothing wrong with taking it for granted.

ing algorithm should always pick up the antecedent with the same head noun as the anaphor[12]:

(64) John$_1$ works at the courthouse as a clerk. Yesterday, he saw a young man, a thief, a robber, a war criminal, and a drug dealer.

a. The criminal is to go on trial at 5pm.

b. After work, he$_1$ had another brief exchange with the criminal.

c. The$_2$ dealer was complaining to his$_2$ lawyer while the criminal paced up and down impatiently.

(64) consists of two sentences which help set up the discourse context. Several people are mentioned, and most of them (besides John and 'a young man') committed a crime of some sort. It is fairly uncontroversial that 'the criminal' in (64a)-(64c) refers to 'a war criminal', and 'the dealer' in (64c) refers to 'a drug dealer'. 'A young man' is never considered because it is less informative than the definite[13], binding would add information to this antecedent and constitute accommodation- a very undesirable course of action given the other solutions available to us. The same example gets complicated quickly as soon as we make a few changes:

(65) John$_1$ works at the courthouse as a clerk. Yesterday, he saw a thief, a robber, a war criminal, and a drug dealer.

a. The criminal who is accused of selling drugs is to on trial.

[12] All of the examples presented in this chapter in the form of (64) should be read by first constructing a pre-existing context according to the numbered (but not lettered) sentences, followed by an interpretation of *either* its a. variant, *or* b., *or* c., and so on; not a. *followed by* b. followed by c. The lettered sentences are *unrelated* to one another.

[13] This indefinite may appear a little out of place, but it is extremely difficult to come up with examples when Type 1 and Type 2 Partial Match must compete for the same anaphor. If I had used 'a man' in place of 'a young man' in (64), it would have appeared very strange for the simple reason that a man is the hyponym of criminals and people generally don't mix ontological categories in the same context.

b. After work, he_1 had another brief exchange with the man who is said to have violated the Geneva Conventions.

c. The_2 dealer was complaining to his_2 lawyer. The criminal paced up and down impatiently.

In (65a), ‘the criminal’ refers to the drug dealer, this is because the relative clause that came with the definite ‘who is accused of selling drugs’ has the closest Partial Match with ‘drug dealer’ using the value-based analysis. What is interesting about this example is that we are seeing a competition between the two criteria we have been using to classify our partial matches. On the one hand, the definite in (64a) picks up ‘a war criminal’ as its antecedent because their head nouns match- even though a drug dealer is a criminal, too. So the form-based approach takes the front seat. On the other hand, the definite in (65a) picks ‘a drug dealer instead’, so the value-based approach wins. What is going on here?

The answer lies in that (65a) is not really an example of Type 1 Partial Match, according to the way we have been classifying them. Instead, it qualifies as Full Match according the value-based analysis according to Definition 12. A drug dealer one sees in a courthouse is essentially equivalent to the criminal who is accused of selling drugs, they denote the same set of individuals in every Model that is consistent with the world we know[14]. The same is true for (65b), although ‘the man who is said to have violated the Geneva Conventions’ does take a bit more world knowledge to translate to ‘a war criminal’. The relation witnessed between the definite description and the antecedent it binds with is that of synonymy. When such relation holds between the two, form-based considerations do not come into play.

(65c) is special because it raises the issue of *recency*. Recency generally refers to

[14]It takes a little reasoning to see that they are meant to be the same thing but this is not so difficult. A drug dealer one sees in a courthouse is probably not dealing drugs, but instead, standing trial. Since one is technically innocent until proven guilty, the alleged criminal can only be *accused* of selling drugs, unless we have evidence from context that he is indeed convicted and sentenced. But if this is the case, then (65a) is likely to have a different reading.

the distance *in text* from the definite description to the last occurrence of its potential antecedent (usually the head noun). Recency is typically measured in sentences, so 'the criminal' in (65c) is one sentence away from 'the dealer' as its antecedent, but two from 'a war criminal' in (65). Some experiments have been done in this area, and what has been generally acknowledged is that interpreters tend to remember the descriptive content of a discourse referent better when its last occurrence falls within a 1 to 4 sentence window. Interpreters also tend to prefer an antecedent when it is introduced by the same head noun as the anaphor, but the memory used to keep track of this deteriorates over time as the antecedent becomes less recent. There is no definitive answer from empirical studies as to whether our consideration for head noun matching should precede recency or if it should be the other way around, particularly in cases like (65c), where one antecedent has the same head noun ('a war criminal') as the definite, but the other is slightly more recent ('the dealer'). For me, (65c) is genuinely ambiguous between the two readings. There are of course arguments regarding *salience*, and since 'the dealer' could be viewed as more salient, it should be the preferred antecedent. This is by all means plausible, but salience is not a lexical property, so I will leave the matter at this.

To sum up Type 1 Partial Match: When the antecedent is more informative than the anaphor or- to put it in value-based terminology- when the Value Set of the definite anaphor subsumes the Value Set of its potential antecedent, then binding is preferred. Specifically, when Full Match cannot be obtained, it is always preferred for a definite description to bind with a Type 1 antecedent over a Type 2 or Type 3 antecedent (a fact, which will explained shortly). Furthermore, if there is more than one Type 1 potential antecedent available in the discourse context, then we must use the form-based approach to look for the one with the closest matching NP, starting with the head noun. Falling short of that, a textually more recent (Type 1) antecedent is preferred over one that is less recent. And finally, if all potential antecedents stand in the No Match relation to the description, then accommodation must be resorted to.

3.3.4 When the Anaphor is More Informative than the Antecedent

Value-Based Partial Match, Type 2:

(66) a. If John has a girlfriend, his oriental girlfriend won't be happy. (Krahmer & van Deemter, 1998, p. 8)

b. If John has a girlfriend, the oriental girlfriend won't be happy.

c. If John owns a donkey, he will be worried about the purple farmer-eating donkey on the loose. (Beaver 1995, p. 61)

In the sentences of (66), the anaphor properly entails those associated with the potential antecedent. The presupposition trigger presents *new* information, or to use our old vocabulary- the presuppositional anaphor is *more informative* than its potential antecedent. We will begin briefly with the original examples taken from Krahmer and van Deemter. According to them, accommodation is preferred over binding in (66a)-(66c). The reason for this, as Krahmer and van Deemter explain, is formulated in the Informative Anaphors Hypothesis (IAH) (Krahmer & van Deemter 1998):

> A potential antecedent with a *non-specific interpretation*, which is less informative than the anaphor under consideration, does not qualify as a suitable antecedent for the anaphor, provided that the relation between anaphor and potential antecedent is one of identity.

Krahmer and van Deemter intends the IAH to be only applicable when the relation between the anaphor and potential antecedent is that of identity, i.e. when they refer to the same individual (or individuals). IAH does *not* apply when the anaphor adds new information about *a subset* of the antecedent, as in "John owns cows. He feels sorry for the mad cows" (plurals pose certain complications, as we will see shortly). (66a) belongs to the identity category, as the possessive 'his' explicitly indicates an identity relation, and according to IAH, there is no ambiguity- 'a girlfriend' is not a suitable antecedent for 'his oriental girlfriend', and accommodation must take place. The same is true for (66b) when we consider binding 'the oriental girlfriend', since 'girlfriend' is less informative, it does not qualify as a suitable candidate. IAH is also the reason why (66c) does not permit the reading where John's donkey is identified with 'the purple farmer-eating donkey…', because the purple farmer-eating donkey is more informative than its antecedent. If we bind, we would get the reading: "If John owns a donkey, and it$_1$ is a$_1$ purple farmer-eating donkey on the loose, then he will be worried that it$_1$ is on the loose", this reading, given the non-specific interpretation of the indefinite, has a rather bizarre entailment to the effect that whenever John owns a donkey, it is a purple farmer-eating donkey on the loose. The alternative would be to accommodate for (66c), and this seems to be obviously preferred.

An important thing to be said about "non-specific interpretation" here is that if the antecedent is *specific*, for example, instead of an indefinite, the antecedent is a proper noun, a possessive, or a definite, then IAH no longer applies. Instances of Type 2 binding to antecedents in the discourse context are often found in newspaper articles, TV and radio broadcasts, or narratives where the speaker's goal is to provide information in a short amount of time. For example:

(67) a. The crowds flooded the National Mall for the "Rally to Restore Sanity", an overwhelming response to a call by Jon Stewart, the political satirist whose comedy show commands a broad, youthful audience of politically engaged Americans. (Stelter & Tavernise, 2010)

b. He (Stewart) saved some of his sharpest lines for the media, … "the country's 24-hour political pundit perpetual panic conflictinator did not cause our problems but its existence makes solving them that much harder"… (Stelter & Tavernise, *ibid.*)

(67) consists of sentences which are excerpts taken from the New York Times. In (67a), the more informative (assuming our readers have no idea who Jon Stewart is) definite NP, 'the political satirist whose comedy show…', refers to Jon Stewart. In (67b), 'the country's 24-hour political pundit perpetual panic conflictinator',

whatever this hyperbole means, refers to 'the media'. These co-references are fairly unambiguous, and readers of the article, whether they are familiar with the subject or not, are expected to be able to make such connections. It is therefore critical to distinguish between the different types of potential antecedents when we are dealing with the resolution behavior of definites. A follow-up observation is how definites are often used discourse-new for the purpose of introducing new information instead of anaphorically refer to something that already exists in the discourse universe. So take for example, 'the crowds' in (67a), as well as the antecedent for the "panic conflicti-natior" that is supposed to be 'the media' in (67b). It can be said that for those examples in (67) which involve a definite antecedent, the definite antecedent is first projected, and then the anaphor (the second definite description) binds to the result of the first projection[15].

Indefinites too, can often be used specifically. There are two notions of specificity which are relevant here: *Epistemic* specificity, and *scopal* specificity (Farkas, 1996). Epistemic specificity has to do with the use of an indefinite, how it is related to the information state of the speaker who uses it. Informally speaking, epistemic specificity can be understood as "the speaker has the referent in mind". Such attitude attributions in philosophical literatures are called *de re* with respect to an epistemically specific (indefinite) NP. Some instances of epistemically specific interpretations of indefinites can be found in (68): 'a clerk', 'a thief', 'a multiple offender', etc. Scopal specificity, on the other hand, has to do with the scope relations in which indefinites stand to quantifiers, conditionals and attitudinal contexts[16]. According to Bende-

[15]Some further examples involving this type of specific antecedents are as follows:

(i) If you fire your rifle too rapidly, the M16 assault rifle might jam.

(ii) This wine tastes horrible. In fact, the 2003 Chateau la Gamarde is the worst of that year.

These sentences can only have a non-projection reading. IAH simply does not apply to them.

[16]It is difficult to give a full and accurate definition to the full spectrum of specificity without devoting several extra pages to it and eventually losing track of our original topic. I can only refer my readers to Farkas (1996; 2002), Bende-Farkas and Kamp (2010) for further discussion. In addition,

Farkas and Kamp (2010), an indefinite NP is given a scopally specific interpretation if it is interpreted as having a scope that is wider than the one indicated by the syntactic position of the indefinite NP and also wider than would be possible for a true quantifying NP in that same position. The examples shown in (66) are all scopally *non*-specific indefinites by virtue of way in which "if-then" constructions are set up. 'A girlfriend' and 'a donkey' are interpreted as 'there is some girlfriend/donkey' when they fall within the scope of the antecedent. Let's see some specific indefinite examples. We try to keep everything reasonably similar to (64), while making sure the anaphor is set up to be more informative than the antecedent:

(68) John_1 works at the courthouse as a clerk. Yesterday, he saw a thief, a robber, a criminal, and a multiple offender.

a. The serial killer is to go on trial at 5pm.

b. The robber who has a track record is to go on trial at 5pm.

c. The_2 robber with a track record was complaining to his_2 lawyer while the petty criminal paced up and down impatiently.

Strictly speaking, with the exception of 'a criminal', 'the serial killer' in (68) does not qualify as a Type 2 Partial Match with any of the other antecedents listed in (68) (it does however, have Type 3 Partial Match with them). Even so, I don't think anybody would bind 'the serial killer' to 'a criminal'. This is particularly true if we decrease recency by distancing (68a) from the sentences in (68) a little, by inserting one or more sentences between them, as in (68a)′:

(68a)′ John works at a courthouse as a clerk. Yesterday, he saw a thief, a robber, a criminal, and a multiple offender. There were a lot of people going in and out of the courthouse, and he had to sit through many trials. The serial killer is to go on trial at 5pm. . . .

von Heusinger (2002, p. 18-24) contains an excellent introductory account to the different types of specificity in relation to the topic of definiteness.

The temptation to accommodate the definite globally is quite strong given these circumstances in (68a)′. Notice how 'the serial killer' shares no actual word with any of its potential antecedents, so that the form-based approach cannot be applied. This is not so in (68b), where the head noun of the definite finds its match from the discourse context. In this case, binding seems to be unproblematic, despite that as a result, we must also add to the discourse referent denoting 'a robber' conditions concerning his track record[17]. The insight gained here is that when a specific antecedent is in the discourse context, a form-based match (head nouns) can potentially eliminate projection under Type 2 Partial Match. The same argument applies to 'the petty criminal' in (68c), as it stands to bind with 'a criminal'. In case there are doubts, here is another example:

(69) John ordered a burger at McDonald's.

  a. The cheeseburger deluxe was both expensive and bad.

  b. He ate the disgusting burger, which was too greasy, and swore to himself never to visit McDonald's again.

Once again, I do not believe that (69a) has an accommodation reading. It must bind. The same is true for (69b), which involves a definite with the same head noun as the antecedent, but also comes with an adjective modifier and a non-restrictive relative clause. As things stand, there is a substantial number of specific antecedents occurring in day to day communication and text, both in the form of definite and indefinite, which Krahmer and van Deemter's theory completely brushes off. IAH simply does not apply to any of them. Our resolution algorithm however, must take them into account. It should classify this type of Partial Match as either bindable to antecedents with matching head nouns, or under certain restrictions, project to the global scope. More extensive empirical tests are needed in order to formulate a theory about specificity and the projection behavior of definites.

[17]It would not matter at all given the context in (68) whether 'the robber' is followed by a restrictive or non-restrictive relative clause. The binding interpretation is very strong for both cases.

In circumstances involving specific antecedents, and when competing antecedents are present, binding which results in adding information to an antecedent is *less desirable* when binding to another antecedent could avoid such addition. Consider (70a):

(70) John ordered a burger at McDonald's when he ran into Mary, who ordered a cheeseburger…

a. The cheeseburger was both expensive and bad.

b. The cheeseburger deluxe was both expensive and bad.

(70a) has a clear cut reading, 'the cheeseburger' refers to 'a cheeseburger' from Mary, for the most prominent reason that it is a form-based Full Match. Still, if we consider (70b)- there is a small degree of ambiguity here, but I think an interpreter will prefer binding 'the cheeseburger deluxe' with 'a cheeseburger' instead of 'a burger'. The actual ambiguity lies in that there could also be a projection reading, when (70b) is meant as an explanation as to why neither John nor Mary ordered a cheeseburger *deluxe*. Under this reading, a cheeseburger deluxe is a different item on the menu compared to a burger or a cheeseburger- 'the cheeseburger deluxe' refers to a very different set of entities than 'the cheeseburger' in (70a)[18].

The Informative Anaphors Hypothesis *does* have its validity with non-specific antecedents, despite the fact that they occur less frequently than the specific ones. The resolution pattern in (70) differs dramatically from that of (71):

(71) If John orders a burger and Mary orders a cheeseburger on their next visit at McDonald's…

a. Then the cheeseburger will turn out to be both expensive and bad.

b. Then the cheeseburger deluxe will turn out to be both expensive and bad.

[18] Not that it matters very much here, but one could of course argue that the same kind of 'intensional' status applies also to a 'cheeseburger' in the first sentence of (70a): When you order a cheeseburger, you put in an order for *some* instance of an item on the menu.

It is plausible for ‘the cheeseburger’ to bind to Mary’s cheeseburger in (71a), because both the form and the value-based Full Match seem to suggest that such binding is preferred. Interestingly, it can be argued that the definite can also project in this case, and (71a) is really ambiguous. But as soon as their textual form start to differ even in the slightest way, as seen in (71b), the IAH correctly eliminates both non-specific antecedents as potential candidates for binding with the definite ‘the cheeseburger deluxe’. An investigation into the causes behind the differentiation in resolution strategies concerning specific and non-specific antecedent is a worthy enterprize, unfortunately for lack of space I will have to set this aside for the future.

Finally, I shall make a brief mention of generics:

(72) A burger at McDonalds is always bad. In fact, the cheeseburger deluxe is both expensive and bad.

(72) involves a generic use of an indefinite (‘a burger’), and it is clear that the accommodation reading of the definite is the only one that should be resorted to, given the limitation of our framework. Generics are special in that they are treated in DRT as if they are universally quantified, even though they appear to be indefinites (Kamp & Reyle 1993, p. 295; Kamp, et al., 2008, p. 157). If we stipulate ‘a burger’ in (72) as such, then the burger will be unavailable as the antecedent for ‘the cheeseburger deluxe’, since its discourse referent is located in the restrictor of the duplex condition, thus inaccessible from the definite. The definite description should project, and even though van der Sandt’s algorithm will yield the correct results here, it does not do so for the correct reasons. A modification of his theory in this regard would have to wait for a more robust account of generic in DRT.

Type 2 Partial Match binding, when the potential antecedent is non-specific, is in general not permitted. As with a specific antecedent, however, the game plan changes completely, and it very much acts like a Type 1: As a general rule of thumb, binding is preferred over accommodation with an epistemically specific antecedent that has a Type 2 (value-based) Partial Match with the definite, *with the exception* that when another potential antecedent is present in the same context, and if that antecedent is Type 1. In that case, the algorithm should opt for adding as little information as possible to the antecedent and bind with the Type 1 antecedent instead of the Type 2. Whenever there is an ambiguity between binding and accommodation for a Type 2 Partial Match with a specific antecedent, one strong indicator for binding is when the form-based approach obtains a matching head noun. If there are no form-based similarities between the anaphor and the antecedent however, then global accommodation may remain as a possible alternative solution (though not anymore preferred than binding).

When the Anaphor and the Antecedent Overlap

Value-Based Partial Match, Type 3:

(73) a. If John has a son, the child will be spoiled.

b. If John talks to some partygoer, the kid will laugh at him.

c. If John has sons, the young children will be spoiled.

d. If John talks to some partygoers, the kids will laugh at him. (Krahmer & van Deemter, 1998, p. 7)

It was explained earlier that the difficulty of coming up with natural examples of the third type of Partial Match is due to the fact that people generally try to be as informative as they could when communicating[19], and this type of anaphoric use of the definite is inherently *vague*. Type 3 Partial Match occurs when for all the interpreter knows, the two Value Sets- the one associated with the presuppositional anaphor of the definite and its potential antecedent- overlap (i.e. that from her perspective, they are consistent, but neither subsume the other). In other words,

[19] I am referring to a footnote in the section titled "the Classification of Partial Match", specifically regarding Grician Maxim of Quality.

there's no incompatibility nor entailment relation between the two sets denoted by the descriptive contents of the anaphor and the antecedent. We will begin by borrowing some examples from Krahmer and van Deemter. In both (73a) and (73b), both binding and accommodation are possible and neither seems preferred. According to common understanding (assuming some general ontology), some sons may be young children, but may also be adults; children may be sons of someone, but could also be daughters instead. Although less obvious, the same observation applies to partygoers and kids as in (73c) and (73d). The resolution of these definites remains ambiguous as the type of partial match does not provide any definite clues.

The problem becomes more interesting when plurals are involved, like in (73c) and (73d). Krahmer and van Deemter notes that accenting sometimes can have a disambiguating function. One of the two possibilities when 'young' or 'kids' are accented is the global accommodation interpretation, such that: "John has young children$_1$. If he has sons$_2$, the$_1$ young children will be spoiled" for (73c)[20] and: "there's a group of kids$_1$. If John talks to some group of partygoers$_2$, the$_1$ kids will laugh at him" for (73d).

The other alternative when 'young' or 'kids' are accented is one of the two possible types of binding when plurals are involved (total identity, or identifying with a subset of the antecedent): If we choose binding, i.e. if we identify 'the young children' to 'sons' (John's sons), what happens is that the set of young children denoted by its referent X is *not* identified to the set of John's sons Y, as we would expect from previous treatments involving only singular discourse referents. Rather, in a binding situation, 'the young children' in (73c) will refer to those sons of John who are young, and 'the kids' in (73d) refers to only those partygoers who are kids as well. Such sub-sective binding links the anaphoric description to the set of those individuals in the set referred to by its antecedents that also satisfy the predicate ('child') of the description. For (73c), we would have: "If John has sons$_1$, the$_2$ young ones amongst them$_1$ will be spoiled", and for (73d): "If John talks to some partygoers$_1$, the kids$_2$

[20]This reading implies that John may have daughters.

amongst those partygoers$_1$ will laugh at him". This is the first type of binding, when accenting is applied.

The second type of binding, *the identity reading* (e.g. the set of John's sons is identified with the set of young children), as Krahmer and van Deemter observes, occurs when there is a *lack* of focus accent on the definite NP. That means John only have young sons in (73c), and there are only kids in the party in (73d). So for instance, in (73c), we would have: "If John has young sons$_1$, they$_1$ will be spoiled", and for (73d), "If John talks to partygoers$_1$ (who are all kids), the kids$_1$ will laugh at him". This is the less likely interpretation of the two, as was noted by Krahmer and van Deemter (1998).

Before we move onto plurals and its interaction with domain restriction of the definite, I would like to raise one more example which affirms Krahmer and van Deemter's intuition that Type 3 is genuinely ambiguous. Once again, we will do away with the "if-then" construction and try to set up more neutral examples:

(74) (Sports commentator:) Some athletes who arrived for the big game yesterday have already passed their preliminary trials. We are really excited because we have some great shows for you today. . .

a. The warmed-up athletes[21] are eager to perform in today's prime time event.

b. The Asians are very much looking forward to the game this year.

c. The participants are all worked up for the exciting show we are about to see.

It is not entirely straightforward to set up a (value-based) Type 3 Partial Match where the anaphor and the antecedent share the same head noun. This task is even more difficult- in fact, impossible with simple NPs. The reason behind it is rather curious, but we won't pursue it right now. Still, we do manage to get it with the help

[21] If the readers find this awkward, replace 'the warmed-up athletes' with the non-restrictive 'the athletes, who passed the drug test'. The difference does not change the results.

of some adjuncts and relative clauses, as found in (74a). Here, binding seems to be the favored choice, while global accommodation of ‘the warmed-up athletes’ is ruled out. The definite in (74a) effectively selects a subset of those athletes who arrived for the big game yesterday. According to (74a), those athletes are also warmed-up and they are eager to perform. Another reading is possible too, particularly when the definite description is de-accented (van Deemter, 1994; 1999). This is the identity reading, and it entails that all of the athletes who arrived yesterday and passed their preliminary trials are warmed-up today.

The definite description in (74b) has no form-based match at all (no word in common) with the antecedent set up in (74), and the binding reading seems just as preferred as the accommodation reading- there simply is no argument strong enough to sway us either way. If binding is chosen, once again, two types of binding can occur. Either all the athletes who arrived and passed their preliminary trials are Asians (the identity reading), or only a subset of those athletes are Asians. The projection reading on the other hand, allows us to assume that there are Asians among the spectators as well as athletes, and to interpret the sentence as saying that both the Asian athletes *and* audiences (i.e. those Asians who are not athletes in the salient context) are looking forward to this year’s game. (74c) is interesting because there are two definite descriptions in this sentence. Each of these descriptions refers to something completely different due to their disjoint Value Sets: ‘The participants’ has a disjoint Value Set with ‘the big game’, therefore they may not bind with each other. Neither is ‘some athletes’ a suitable binding candidate for ‘the exciting show we are about to see’. The only possible match for ‘the participants’ in context is ‘some athletes’, and ‘the exciting show’ ‘the big game’. Both combinations are classified as Type 3 Partial Match. Binding ‘the participants’ with ‘some athletes’ will either have the identity reading, or the reading where the definite refers to those athletes who arrived and are also participants to the big game. The difference between these two readings is somewhat blurred, because the way in which the discourse context is set up in (74) has the implicature that those athletes who arrived at the game and passed their preliminary trials will be participating in it. One could also interpret 'the participants' in (74c) with a projection reading. According to this reading, 'the participants' will probably include coaches, cheerleaders, audiences, plus all kinds of people and professionals who usually take part in a big sports event besides athletes, there is no clear obstacle against establishing such a reading from the discourse shown in (74). Binding 'the exciting show' to 'the big game' seems to be pretty reasonable, even though this is not the only way to make sense of (74c) nor is this particular binding mandatory. If the decision is to globally accommodate 'the exciting show', then it will simply refer to another event that is somehow related to 'the big game'- perhaps an opening ceremony, or a pre-game party, and so on. There is nothing out of the ordinary here.

Another potential antecedent in the discourse context (74) which has a value-based Partial Match with 'the exciting show' is the indefinite plural 'some great shows'. As with other types of Partial Matches we have discussed up to this point, a match in the head noun makes binding much easier. Binding to the antecedent with the same head noun would have 'the exciting show' pick out a member from the set denoted by the plural NP 'some great shows', thus yielding: "... We are really excited because we have some great shows$_1$ for you today... The participants are all worked up for the exciting show amongst them$_1$ which we are about to see." In all likelihood, 'the exciting show' could be co-indexed with 'the big game' and one of the 'great shows' that the sports commentator presumably has in mind. From this reading, an interpreter can deduce that there are probably more 'great shows' than just the big game; or alternatively, if we do decide to project 'the exciting show', then it does not get identified with 'the big game'. Still, since the head noun 'show' is being shared among the plural antecedent 'some great shows' and the definite anaphor 'the exciting show', binding is more preferred in this instance of Partial Match, and we get the reading: "There is an$_1$ opening ceremony (or a show that is not 'the big game'). We are really excited because we have some$_2$ great shows for you today. The participants are all worked up for the$_1$ opening ceremony (which is among them$_2$) we are about to see."

A short summary about Type 3 Partial Match: When there is no matching of head nouns between the anaphor and the potential antecedent, then both binding and global accommodation are equally preferred, the reading is ambiguous between the two. However, when there are matching head nouns in Type 3, then binding is strongly preferred. Plurals are special because for them, two binding readings are possible. One is the identity reading where the non-atomic anaphor gets identified with the non-atomic antecedent discourse referent. The other is the sub-sective reading when the anaphor is identified with a subset of its potential antecedent. The choice between these two depends on accenting. The latter is preferred when there is focus articulation on the definite description, and the former when the definite is de-accented.

3.3.5 Genuine Ambiguity

We have seen several examples where it looks like a definite description can be interpreted as anaphoric to either of the two available antecedents. Such ambiguities do not only occur with Partial Matches, but also arises in Full Match. Neither value nor form-based approach is able to determine the proper resolution strategy for the definites that appear in the following:

Genuine Ambiguity:

(75) a. A man was quietly walking down the street, when he was joined by another man. The man said… (Krahmer & van Deemter, 1998, p. 6)

b. A cat was quietly walking down the street, when it was joined by another cat. The critter was run over by a truck and died instantly.

c. A cat was quietly walking down the street, when it was joined by another cat. The cute little kitten got run over by a truck and died instantly.

d. A fat cat was quietly walking down the street, when it was joined by a young cat. The black cat got run over by a truck and died instantly.

For the sentences in (75a)-(75c), there is a genuine ambiguity between two possible resolutions of the definite description. Since the descriptive content (thus the discourse conditions) of the two potential antecedents is exactly the same, the competing antecedents stand in the same match relation to the anaphor. So these examples demonstrate clearly that there are cases where neither the value-based approach nor the form-based approach, nor a combination of the two, can help the interpreter make a choice. Assuming complete absence of pragmatic cues (e.g. the speaker does not point with his finger to a particular man when uttering the second sentence of (75a)), the presupposition resolution algorithm for 'the' ought to generate all the possible interpretations for each of the above sentences. So, for (75a), we obtain one reading where the definite binds with the first man, and another on which it binds with the second man, without any clear preference of one reading over the other. (75a) demonstrates the ambiguity in choosing between Full Match antecedents (measured in terms of both their value and form), but the same kind of ambiguity appears also in (75b)-(75d), although these examples invoke the three different types of Partial Matches we have already talked about. (75b) is of Type 2, and (75c) is of Type 3 Partial Match. (75d) shares a slightly different setup from that of the others in that the descriptive content of the competing antecedents are not identical ('fat cat' vs. 'young cat'). Both of these antecedents have a Type 3 Partial Match with the anaphor 'the black cat'. If we resort to binding as a means to resolve the definite in (75d), the algorithm will not be able to decide on the basis of value-based Partial Match which of the two is the more preferred.

In principle, we want the lexical entry for 'the' to be able to handle situations like these and generate all of the possible and acceptable interpretations when a genuine ambiguity arises. That is not to say that once all possibilities have been listed, preferences cannot be decided. Various models of the Centering Theory may come into play (Brennan 1995; Beaver 2004, etc), likewise, focus articulation can place one antecedent over the other in a more preferred position to identify with the presuppositional anaphora, and we will relate to this point at a later stage of our discussion.

Clearly, cases of referential ambiguity like that of (75) do not encourage wholesale accommodation. While it is unclear to which antecedent the description is to be bound, binding (to one of these antecedents) is the only option.

An inquiry may be raised out of mere curiosity- What about some variations of the example in (75d), where different types of Partial Matches are put together in the same sentence? Well, the only way to find out is by looking at more examples:

(76) (It was a dark, moonless night and the speaker could not see very well what is going on in the street. . .)

a. Some critter was quietly walking down the street, when it was joined by a cute little kitten. The cat was run over by a truck and died instantly.

b. A cat was quietly walking down the street, when it was joined by a black cat. The critter was run over by a truck and died instantly.

c. Some critter was quietly walking down the street, when it was joined by a cute little kitten. The black cat was run over by a truck and died instantly.

(76a) has a Type 2 Partial Match ('some critter', 'the cat') followed by a Type 1 Partial Match ('a cute little kitten', 'the cat'). It was said in an earlier section that binding with a Type 1 Partial Match is always preferred over Type 2, and this example is no different. The definite 'the cat' should be interpreted as referring to 'a cute little kitten'. This prediction is consistent with our intuition.

(76b) starts off with the first potential antecedent having a Type 1 Partial Match with the definite anaphor ('a cat', 'the critter'), this is then followed by a contesting Type 3 Partial Match antecedent ('a black cat', 'the critter': Note that not all critters are colored black). Binding 'the critter' with 'a cat' adds no new information to the antecedent; Binding to 'a black cat' adds no new information either. Therefore we have a Genuine Ambiguity.

(76c) begins with the same Type 2 Partial Match as (76a), but instead it is followed by a Type 3 Partial Match ('a cute little kitten', 'the black cat'). It seems rather ill-advised to go either way, because binding with either one would require adding more information to the antecedent. There is however, a certain temptation to bind ‘a cute little kitten’ to ‘the black cat’ for the following reasons: (Value-based argument) 1. Their Value Sets overlap more[22], therefore binding the two requires less addition of information to the antecedent. (Form-based argument) 2. The head noun ‘kitten’ is morphologically more similar to ‘cat’. An equally, if not more preferred resolution would be to simply accommodate ‘the black cat’. The likelihood of this recourse will increase if the recency of the second sentence of (76c) diminishes, that is, if we put more material between ‘the black cat’ on the one hand and ‘some critter’ as well as ‘a little cute kitten’ on the other. The extent of the influence exerted by the value-based and form-based approaches is very hard to measure in such examples, and I do not think there really is a definitive answer to what the interpretation to (76c) ought to be, so I will leave it at that.

3.4 Accommodation

The previous section has been devoted to a discussion that assumes binding is preferred over accommodation. The focus of that discussion is on the different circumstances in which binding can take place, and when there is more than one potential antecedent in the discourse context, which ones are more preferred over the others. Almost nothing has been said about the other half of the topic of presupposition resolution, which has to do with *accommodation*. It is very likely that accommodation as a concept historically precedes binding. Linguists such as Stalnaker (1972, p.398) and Karttunen (1979, p.191) have long recognized how sometimes “tacit extensions”, or

[22]Exactly how this is calculated is unclear without a comprehensively and formally defined ontological structure that is imbued in our Model of interpretation. Still, it would not be far fetched for the time being to estimate that there is a higher percentage of cute little kittens that are also black cats, than critters that are black cats.

In case there is any confusion, a ‘critter’, according to the Oxford Dictionary, means: “A living creature; an animal.”

"minor revision" of the context ought to be made on the part of a hearer in order to understand certain presupposition carrying expressions and in order that the conversation can continue. The term "accommodation" did not emerge until Lewis (1979). Exactly how such "revision" or "extension" takes place is not spelled out until Heim (1983b), and later in DRT, by van der Sandt (1992). Like binding, accommodation is not thought of as part of the compositional construction of semantic representations, instead, accommodation has consistently been thought of as a kind of *context repair strategy*- which belongs to a separate, semantic-pragmatic phase of sentence interpretation.

Throughout our discussions about the different Types of matches in the last section, we have identified several circumstances under which either accommodation should precede binding, or the choice between these two strategies is ambiguous. In such cases, an algorithm for presupposition accommodation must be made available so that the reading can be obtained. A concise list of those circumstances is as follows:

- When the anaphor is more informative than the antecedent, a Value-Based Type 2 Partial Match…
  - And when there is only a non-specific antecedent in the discourse context.
  - Or, when there is a specific antecedent in the discourse context, but this antecedent has no form-based match at all with the anaphor.
- When the anaphor and the antecedent overlap, a Value-Based Type 3 Partial Match…
  - For singular NPs, there is an ambiguity between binding and accommodation.
  - For plural NPs, focus articulation on the plural definite description indicates an ambiguity between the sub-sective binding and global accommodation.

- Genuine Ambiguity always requires both the binding reading and the global accommodation reading.

- No Match always requires global accommodation.

The resolution algorithm will have to assign an accommodation reading given the above circumstances. Typically, when we accommodate a presupposition, we are confronted with the question as to where and why? Recall in van der Sandt (1992), for conditional and quantificational constructions, the possibilities are always three: Global, intermediate, and local. However, the sense in which the term 'accommodation' is used throughout this chapter, and the sense in which it is meant by Krahmer and van Deemter has been implicitly restricted to global accommodation, or presupposition projection. In other words, the answer to the question as to where to accommodate under those circumstances listed above is therefore: Global. To offer an explanation as to why that is, I would like to argue *against* the adaptation of intermediate accommodation generally and propose an accommodation strategy for quantificational expressions which operates exclusively at the global level, but is capable of producing what may superficially look like intermediate accommodation effects.

3.4.1 What is Intermediate Accommodation

Intermediate accommodation in general is a result of the failure to accommodate globally, either because doing so would cause inconsistency, or produce unbound variables. Some of the most typically cited examples in favor of intermediate accommodation were mentioned in (28), and we now re-listed them below (Heim, 1990; van der Sandt, 1992):

(77) a. Everyone who serves his king will be rewarded.

b. Everyone will serve his king.

Intermediate accommodation is necessary, so the argument goes: For (77a), global accommodation of the possessive presupposition *à* la van der Sandt, which is triggered in the antecedent, will result in an unbound variable. Likewise for (77b), while the trigger is located in the consequent. For both examples, intermediate accommodation is chosen as the most preferred resolution by the Resolution Preference ordering. (77a) reads: "Everyone who has a king and serves his king will be rewarded". (77b) gives us the reading: "Every man who has a king will serve him". But there are some problems with intermediate accommodation in general. For one thing, while a relative clause such as the one in (77a) licences intermediate accommodation, the strategy adopted for (77b) potentially leads to infelicitous examples. Consider the following question and answer (Beaver 1994a; 2001; 2002):

(78) a. How many team members and cheerleaders will drive to the match?

$*$ Few of the 15 team members and none of the 5 cheerleaders can drive, but **every team member will come to the match in her car.** So expect about 4 cars.

b. How many team members and cheerleaders will drive to the match?

Few of the 15 team members and none of the 5 cheerleaders can drive, but every one of those few team members who owns a car will come to the match in her car. So expect about 4 cars.

It seems that the intermediate accommodation reading in (78b) for the boldface sentence in (78a) would make sense under the given context, but why then does (78a) sound so strange?

Several different explanations have been offered to answer this question. One of this can be found in (Beaver, 1994a). Here, Beaver suggests that quantificational domain restriction (in this case intermediate accommodation) is not caused by presuppositions, but rather by topicality. He maintains that "people do not accommodate presupposed material so much as accommodate a topic, or, more precisely, accommodate that a certain set of individuals is topical, and that the sentence is about that set... what is wrong with van der Sandt's theory is not the set of logical possibilities it offers for interpretation of sentences of this type, but his claim that the domain restrictive interpretation of a sentence is caused by the presence of a presupposition. I claim that domain restriction must result from the structure of the surrounding text and the topic-focus articulation of the sentence" (Beaver, 1994a, p.5). This explains why intermediate accommodation seems okay in (77b), but not in (78a), since 'his king' in (77a) is considered a topic, but not 'her car' in (78a). However, this explanation is hardly satisfactory, since Beaver himself admits that there are no available definitions for *sentence topic* and *discourse topic*. Yet, another suggestion by Beaver in (Beaver, 2001) is that intermediate accommodation should be heavily constrained if ever allowed, because it is related to *genericity*. To put it more specifically, intermediate accommodation should only be applied when the quantificational domain of a statement is unclear, so take the example that was mentioned earlier in (54), restated below (Beaver 2001, p.119):

(79) a. Every German woman drives her car to work.

b. Between 9:00 and 9:30 yesterday, every German woman drove her car to work.

(79a) adopts essentially the same intermediate accommodation as (77b)- for exactly the same reasons. It reads: "Every German woman who has a car drives her car to work". There is a certain level of ambiguity in both of these sentences, 'every German woman...', 'everyone...'- the question is, 'every' of what? The speaker who utters these sentences ought to have a certain relevant set of German women (for (79a)) or people (for (77b)) in mind, or some established context that give rise to a relevant domain where those German women or people stand out. As soon as we get more specific, like the sentence in (79b), the tendency to accommodate intermediately is diminished, or even disappears. (79b) only seems to allow for the interpretation: "Every German woman has a car. Between 9:00 and 9:30 yesterday, every German woman drove her car to work." Beaver's explanation for this is that "quantificational statements are always anaphoric on some set which is assumed to be salient, but that when this set has not been introduced explicitly, the hearer must globally accommodate a referent for the set. Then the intermediate accommodation readings would be explained without recourse to intermediate accommodation, but only in terms of global accommodation. Further, such readings would be blocked whenever the domain of a quantificational statement was clearly linked to an explicit antecedent"(Beaver 2001, p.120).

This observation seems right, and I will adopt it and elaborate it in our DRT formalism. But first, we need to say a little about domain restriction in quantificational and definite expressions.

3.4.2 Interlude: The Contextual Restrictor C

Contextual restriction of quantifying expressions can be found implicitly in all of the more recent versions of DRT (Kamp & Roßdeutscher, 1994a; Kamp, 2001b; Kamp et al., 2008). The notion traces back to Westerståhl (1984), von Fintel (1994), as well as Stanley & Szabo (2000). Contextual restriction is a mechanism for restricting quantification in natural languages. I would like to argue in this section that contextual restriction enters into the interpretation of the (quantificational) uniqueness presupposition of definite descriptions no less than quantifiers. But let us first briefly look at some typical examples of contextual restriction of quantifying phrases:

(80) a. The English love to write letters. Most children have several pen pals in many countries.

b. Whenever John shows up, most people tend to leave. (Peters & Westerståhl, 2006, p. 45)

c. Many people showed up at the game yesterday. The visitors from Britain were especially excited.

In the second sentence of (80a), 'most children' does *not* refer to most of all the children in the world- it should be quite clear that the domain in which the quantifier 'most' is interpreted is restricted to the set of all English children. This restriction is imposed by the topic of the first sentence 'the English'. The domain of quantification is the set of children belonging to this topic- or, if you like, those children that belong to a subuniverse determined by this topic. The subuniverse which the NP of a quantifying DP carves out is often contextually given, and its relevance tends to be limited to particular NP occurrences. So for this example, the set of all English children is only for 'most children', and not for 'several pen pals' nor 'many countries'. These other NPs will need their own domain restriction[23]. The set resulting from domain restriction can often *bind* with other discourse referents. This is demonstrated in (80b)- 'most people' is interpreted as involving domain restrictions that depend on the occasions of John showing up- for every occasion of John's being present, there is a different set of people present, most of which then tend to leave.

To represent domain restriction (for the definite) in DRT, we make use of the *contextual restrictor* C. Every quantifying NP comes with a unique C. C is a presupposition in the form of a discourse referent that ought to be identified to some subset of the discourse universe accessible from its position. Moreover, I will from now on assume that the mechanism of contextual domain restriction also operates in connection with definite NPs, and it is on these cases I will focus. The descriptive content of the definite NP will provide 'contextually restricted' predicates. For example, in the context provided by the first sentence of (80c), 'the visitors from Britain' is read as 'the visitors among those who showed up at the game yesterday who are from Britain', i.e. people who showed up at the game yesterday ∩ visitors from Britain. Generally speaking, a definite NP in the form presented in Entry 1 should be interpreted as:

[23]Westerståhl (1985) uses the term 'contexts sets' to describe such restricted domain, however, to avoid confusion with the 'context set' from Stalnaker (1974), I will not use it here. Instead, I will refer to this domain restriction later on as the 'contextual restrictor'.

$M \models_f P'(x)$ iff $f(x) \in I_M(P') \cap f(C)$, for singular definite descriptions.

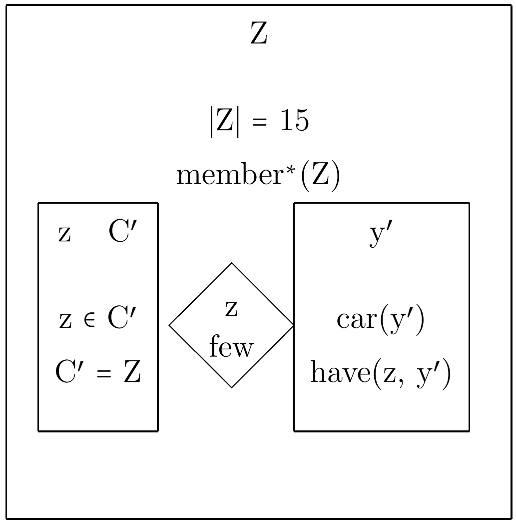
$M \models_f P'(X)$ iff $f(X) \in I_M(P'^*) \cap f(C)$, for plural definite descriptions.

3.4.3 Some Arguments Against Intermediate Accommodation

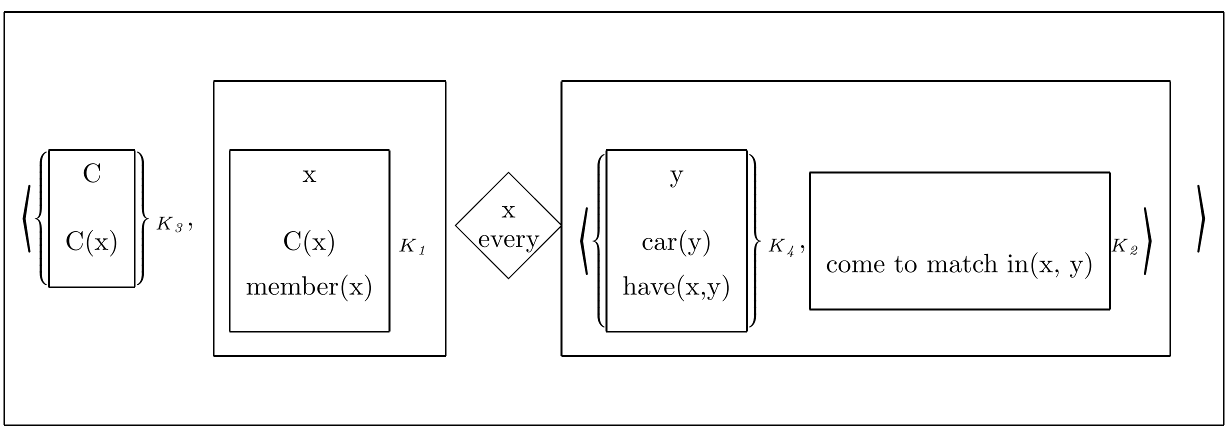
Let us return to intermediate accommodation. To begin, consider the following similar but shortened version for (78a):

(81) * Few of the 15 members have a car, but every member will come to the match in her car.

The first conjunct serves as the context for the interpretation of the second conjunct. Although there are no generally defined truth condition for 'few', it is part of the meaning of 'few' that "few P's are Q's" always entails that some P's are Q's. Furthermore, like all other quantifiers, 'few' typically requires a domain restrictor which can be either implied or explicit. In the first conjunct of (81), it is given explicitly by the partitive NP 'the 15 members', that is part of the quantifying NP 'few of the 15 members'. In the DRS Φ below, for the first conjunct of (81), this set is represented by the discourse referent Z:

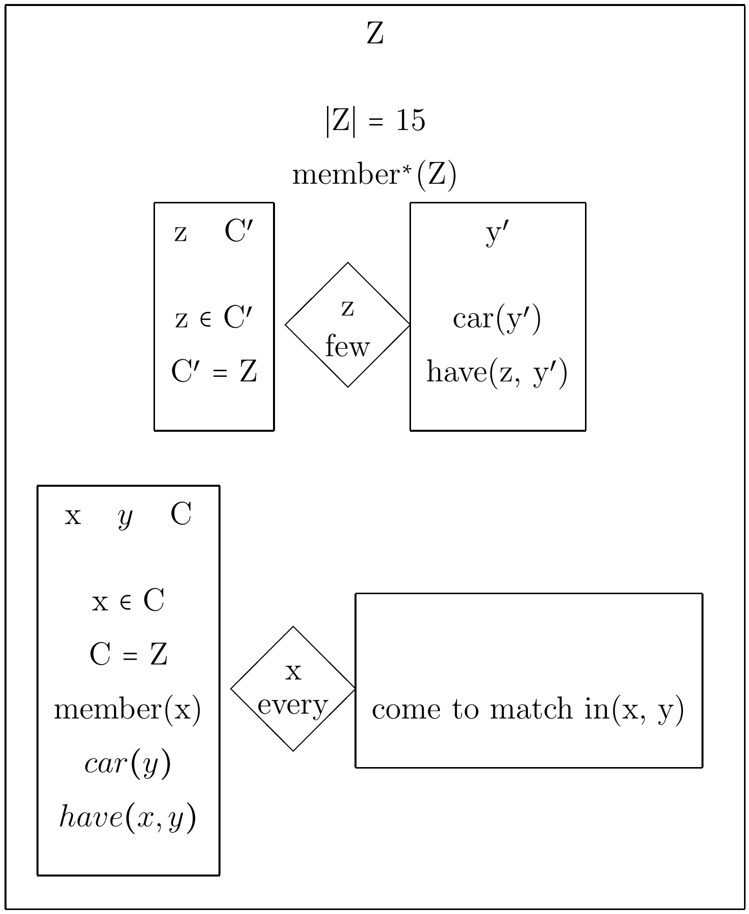


Φ states that out of the 15 members out there, few have cars. The quantifier ‘every’ in the second conjunct of (81) has no explicit restrictor apart from that imposed by its head noun ‘member’, and therefore invites contextual reconstruction of a further domain restriction. In the present case, the identification of this restriction is determined by the ‘anaphoric’ connection between the two occurrences of the (head) noun ‘member’: The second occurrence of ‘member’ is interpreted as ‘picking up’ the quantification domain associated with the first occurrence. The second conjunct of (81) has the following Preliminary DRS Ψ:



For the above Preliminary DRS Ψ, the car possession presupposition (‘her car’) is triggered from the nucleus of the duplex condition in the assertional DRS, whereas the trigger of the contextual restrictor presupposition involving C is the quantification expressed by the NP 'every member'. The first presupposition is adjoined to the nuclear scope DRS and the second to the duplex condition as a whole. In other words, the possessive presupposition K_4 is adjoined to the nuclear scope DRS K_2 while the domain restriction presupposition K_3 is adjoined to the duplex condition that represents the 'every' quantification. To resolve these presuppositions, we first treat C as an anaphor seeking an antecedent. Mandated by the anaphoric relation between the two occurrences of 'member' in (81), C is identified with Z. It is clear that we now face a problem when we try to resolve the existence presupposition associated with the description 'her car' after having resolved C to Z, with 'her' represented by x (thus connected to C). The existence presupposition licences that x has a car. This presupposition must then be satisfied for every x in Z (local accommodation), but the DRS Φ for the first conjunct of (81) tells us that this is not so. Hence interpretation aborts at this point, and we end up with an uninterpretable sentence. This is in fact, *the way it is supposed to be* for (81).

However, according to van der Sandt (1992), failure of the 'her car' presupposition to bind should lead to accommodation, and since global accommodation would lead to an unbound variable here, accommodation must take place at the intermediate level of the restrictor of the 'every' quantification. If we do this, we would end up with the following DRS Θ:



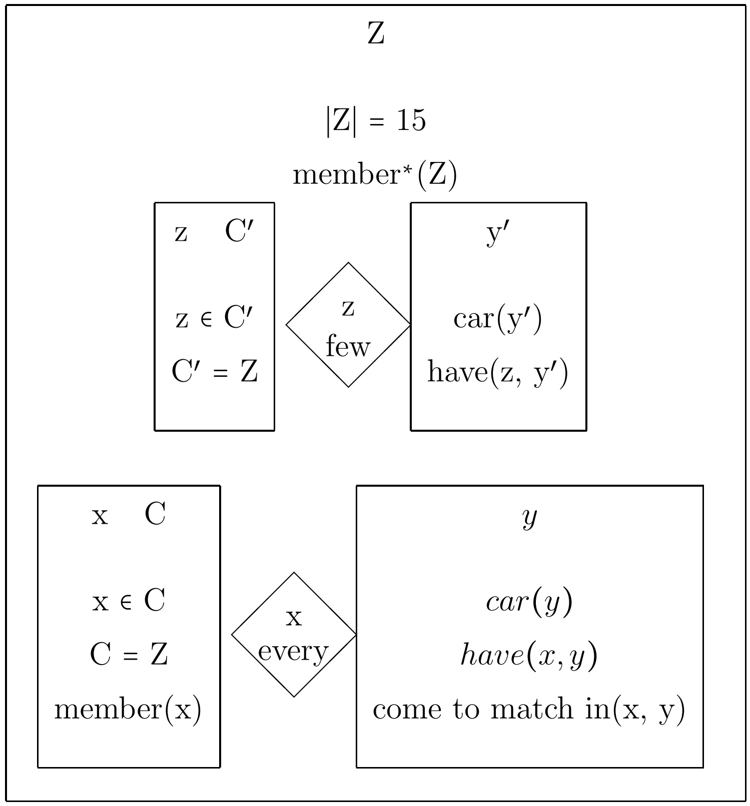
Θ has the informal reading: "Few of the 15 members have a car, but every one of those 15 members *who has a car* will come to the match in her car". Our intuitions tell us that this cannot be a possible reading for (81). So how could we prevent this from happening?

Van der Sandt's model has very little to say about the effect of domain restriction (by definites in particular). In his model, to accommodate a definite in the intermediate scope means we either get a reading like the one in (78b), where 'every team member' refers to those few members from the set of 15 specified in the antecedent who own a car; or (if we delete C, x∈C and C=Z from Θ) that every member in the Model of interpretation who has a car will come in her car, regardless whether that member belongs to the set of 15 members we are talking about. Without a contextual restrictor, is not entirely clear which one of these should be the right interpretation. But if we give him the benefit of the doubt and say that contextual restriction is implicit in his theory, then the latter possibility must be ruled out. Even so, the former reading is questionable- There is no apparent justification for C to identify with Z, that is, there is no reason why the 'every member' of the second conjunct in (81) should be linked to the 'few members' of the first so that they share the same contextual domain. But if this 'every member' is to be read as 'every member who owns a car' under van der Sandt's intermediate accommodation, then who are these members?

The missing 'link' lies in the anaphoric relation between the two occurrences of the noun 'member' in (78a) and (81). The point was repeatedly suggested during the Partial Match demonstrations earlier that head nouns play an integral role in the resolution of definites, particularly when there is an ambiguity between two equally preferred (value-based) Partial Matches. A quantifier phrase like 'every member' in the second conjunct of (81) is apparently subjected to the same influence by the head noun as the definite. It is 'anaphoric' to the first occurrence of 'member' in that it takes out the set that is denoted by the definite descriptions the 15 members of which that first occurrence of 'member' is the head. In this regard, the relation between the two occurrences of 'member' is very much like what it would have been had the second conjunct of (81) been: "... but *the members* will all bring their cars to the match". Here, we have another definite description ('the members') over which the verb phrase 'bring their cars to the match' describes, getting the quantification effect in this alternative way. In the alternative version, 'the member' can be analyzed as simply anaphoric to 'the 15 members' in the first conjunct of (81) (Type 1 Partial Match), with the effect that the two phrases denote the set of 15 members, while the second occurrence of 'member' is the head of a quantifier phrase (as it is in (81)). By using the contextual restrictor C, this anaphoric connection between the first and the second 'member' is spelled out explicitly. For (81), both quantifiers 'few' and 'every' ranges over the same domain Z, set out in the global DRS. 'Few' relies on its own contextual restrictor C′, whilst 'every' relies on C.

All this comes together nicely with the analysis of 'the' as taking the maximal set of satisfiers of the predicate that follows it (i.e. the maximal set satisfying P' in C), whereas a quantifying determiner like 'every' quantifies over this set ($P' \cap C$). On this view then, it is the head noun of the description of a quantifier phrase that is specifically responsible for the anaphoric connections. It must select a set, and it can do that either without the help of the context or with its help. And when it uses the context, then that is by linking up with, or asking for the accommodation of some context set with which it then intersects. An important aspect of this feature is that when the set offered by the context is sufficiently 'salient' (Lewis, 1979), then choosing that set is obligatory- that is the moral of (81). It is also part of that moral that repetition of the noun ties the set associated with the second occurrence to that associated with the first.

It is in my opinion that intermediate accommodation should not be allowed at all, because doing so would permit readings like that in Θ which may appear to be perfectly legitimate- but for infelicitous sentences like those of (78a) and (81). In Θ, by accommodating the car possession presupposition in the restrictor for 'every', we have in effect assigned those few members who have cars, $Z' \subset Z$, to be the domain of 'every'. But that is not what the second sentence is supposed to mean. By virtue of the anaphoric link between 'every member' and 'the members', 'every member' means 'every member *of* the 15'. On the other hand, if we accommodate the car possession presupposition ('her car') in the location in which it was triggered (nucleus scope), i.e. if we accommodate locally, then we should have the following DRS Θ':



Θ' seems to be a proper characterization of (81), because it contradicts itself. On the one hand only few of the 15 members have cars, and on the other hand every one of the 15 members have cars. Knowing that ‘few X VP’ implies ‘at least one X not VP’, we may conclude that this contradicts with ‘every X VP’. Incidentally, this is how we would normally understand the two sentences in (81).

Now, if we backtrack and look at an example such as (79), when a sentence like (79a) is uttered out of blue (with no pre-existing context), in our approach the quantifier ‘every’ should range over the entire context. The reason behind this is because the contextual restrictor C for ‘every German women’ appears to have been “accommodated” into the global DRS, since unlike the ‘every member’ in (81), it lacks an explicit antecedent. And although it gives off the impression as if C has been “accommodated”, in reality, C is just identified to the discourse universe of the global DRS (thus the “ ” around “accommodated”)- essentially *binding* to the set of all referents on the topmost level. The presupposition attributed to ‘her car’, which is triggered in the nuclear scope is then imposed upon this C, further restricting it to a set consisting of car owners. This can be viewed as a special kind of accommodation that is only available in sentences that Beaver describes as "having a distinctly generic flavor" (so the same is true for (77b)). As soon as we move onto (79b), this is no longer permitted. The contextual restriction from 'between 9:00 and 9:30 yesterday' has somehow 'fixed' C to the extent that it no longer permits stipulation from the possessive. (79b) can only imply that every German woman has a car.

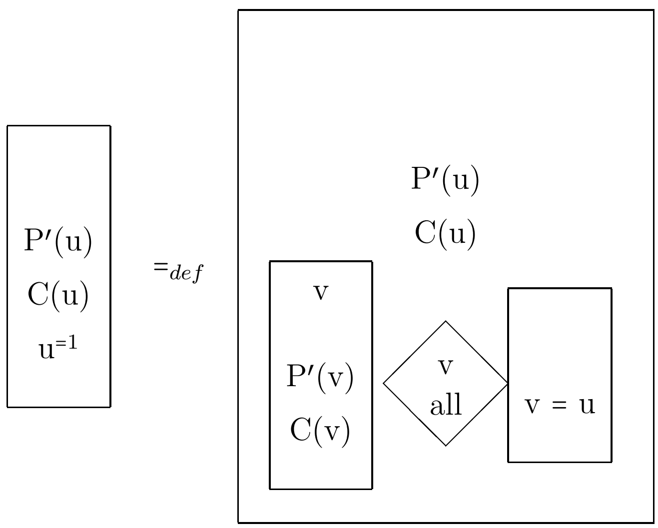
There is clearly a story to be told here about contextual restriction and its relation with genericity. For the meantime, I will only go so far as to say that intermediate accommodation should be understood as the effect of contextual restriction, after C has been bound globally or to an antecedent. In our DRT framework, intermediate accommodation causes problems, and should thus be unavailable as a resolution strategy.

3.4.4 the Uniqueness Presupposition

The other motivation for having a contextual restrictor has to do with the *uniqueness constraint* presupposed by the definite determiner. It was said towards the very beginning of this chapter that the definite determiner not only presupposes the existence of an individual that satisfies the descriptive content of the N (noun) it adjoins, but also there is an associated uniqueness condition, such that for example, upon uttering "the N VP" in a context with more than one N, an ambiguity results. Uniqueness must be understood as *uniqueness within some contextually restricted domain*, this domain is represented by the contextual restrictor C. C is therefore an essential part of the presuppositions triggered by the definite, and as we have seen in examples (78)-(81), it too must either bind or accommodate. If we set aside for a moment the context dependent predicate C and the presuppositional status of the descriptive content of the description, the semantic structure for a definite description is quite reminiscent of Russell's proposal for the logical forms of sentences with definite descriptions (Russell, 1905). For a sentence in which the description is the sentence subject, N is the predicate representing the description's descriptive content, while VP represents the content of the verb phrase, Russell proposes the following logical form[24]:

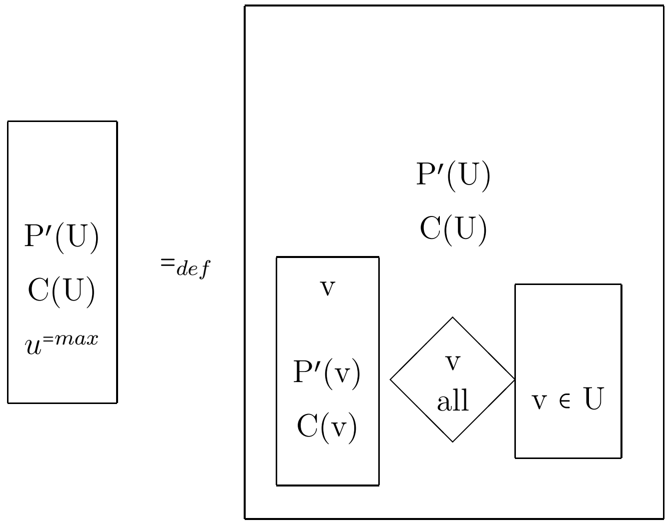
$$\exists x\ \forall y\ (N(x) \wedge (N(y) \rightarrow x = y) \wedge VP(x))$$

For singular definite descriptions, the uniqueness constraint is imposed upon C by the condition $u^{=1}$. $u^{=1}$ is an abbreviation for Russell's characterization of the uniqueness property for *singular* definites. What $u^{=1}$ entails is that for every individual in the contextual domain, *only one* may fulfil all of the conditions that are attached to u (P′ is the discourse condition attributed to the noun N, the non-italicized 'u' is an *atomic* variable):



The uniqueness constraint for plural definite NPs is somewhat different because u must consist of more than one element (it is non-atomic). For this reason, the uniqueness constraint of a plural must be adjusted to ensure that u is the *maximal set* under C that satisfies P′. We will write this constraint as $u^{=max}$. Let U be a *non-atomic* variable, $u^{=max}$ stands for:

[24] An example of such formulation can be found in (5) of Chapter 1.



Now we are ready to put the pieces together. The uniqueness constraint must function in conjunction with our earlier insight that the definite determiner *presupposes existence* of an individual that satisfies N (refer to Entry 1). The definite has the potential to introduce a new discourse referent on N's behalf. This discourse referent must stand unique in the relevant contextual domain C. The relation between the existence and the uniqueness presuppositions is assumed to be that of presupposition as well, just as how the existence presupposition can be seen as presupposing C[25]. This means we may represent the existence presupposition as left-adjoined to the uniqueness presupposition in our lexical entry. We incorporate these two presuppositions and their contextual restrictor C into our new entry for the definite article:

[25] Whether uniqueness truly 'presupposes' existence is a rather metaphysical question, and I do not intend to get into metaphysics here. It is for theoretical expedience that we should look at it this way: Uniqueness cannot be realized without some form of (abstract) existence of the unique entity in question. On top of that, uniqueness cannot be defined without a certain relevant domain C where the entity is uniquely identified. These relations can either be asserted or presupposed according to the theory at our disposal. Since they are obviously not asserted, we assume presupposition.

$$\lambda P' \, \lambda P \, \left(\left\langle \left\{ \left\langle \left\{ \left\langle \left\{ \begin{array}{|c|}\hline C \\ \\ \\ \hline \end{array} \right\}, \begin{array}{|c|}\hline u \\ \hline P'(u) \\ C(u) \\ \hline \end{array} \right\rangle \right\}, \begin{array}{|c|}\hline u^{=1/max} \\ \hline P'(u) \\ C(u) \\ \hline \end{array} \right\rangle \right\}, \begin{array}{|c|}\hline \\ \\ \hline \end{array} \right\rangle \oplus P(u) \right)$$

This is a rather clumsy layout of the essential components as things stand, but all three presuppositions attributed to the definite are paraded on display: Beginning with the innermost presuppositional DRS is the contextual restrictor C. C is presupposed by the existence presupposition, and existence by uniqueness. The resolution algorithm should process in that particular order, because C is the prerequisite for existence, and existence the prerequisite for uniqueness[26]. There is of course a much more elegant way of conveying the same ideas:

Entry 2, 'the' for definite NPs:

$$\lambda P' \, \lambda P \, \left(\left\langle \left\{ \begin{array}{|c|}\hline C \quad u \\ \hline u = \Sigma\, u. \begin{array}{|c|}\hline \\ \hline P'(u) \\ C(u) \\ \hline \end{array} \\ \hline \end{array} \right\}, \begin{array}{|c|}\hline \\ \\ \hline \end{array} \right\rangle \oplus P(u) \right)$$

Just like Entry 1, when 'the' is combined with a 'singular' number feature, then the cardinality of the set satisfying P′ is set to one, i.e. u must be atomic:

[26] There remains the question as to what exactly *is* an anaphor, what constitutes an "existence" presupposition. Like my predecessors, I have simply taken it for granted up to this point that an anaphor simply places a requirement on the context to provide a compatible antecedent. But this is not always correct. More about this is said in the Articulated Contexts section in the next chapter.

Entry 2, 'the' for *singular* definite NPs:

$$\lambda \mathrm{P}' \; \lambda \mathrm{P} \; \left(\left\langle \left\{ \boxed{\begin{array}{c} \mathrm{C} \quad u \\ \\ u = \Sigma \; u. \boxed{\begin{array}{c} \mathrm{P}'(u) \\ \mathrm{C}(u) \end{array}} \\ \\ |u| = 1 \end{array}} \right\}, \boxed{} \right\rangle \oplus \mathrm{P}(u) \right)$$

Entry 2, 'the' for *plural* definite NPs:

$$\lambda \mathrm{P}' \; \lambda \mathrm{P} \; \left(\left\langle \left\{ \boxed{\begin{array}{c} \mathrm{C} \quad u \\ \\ u = \Sigma \; u. \boxed{\begin{array}{c} \mathrm{P}'(u) \\ \mathrm{C}(u) \end{array}} \\ \\ |u| \geq 2 \end{array}} \right\}, \boxed{} \right\rangle \oplus \mathrm{P}(u) \right)$$

Given the above DRT apparatus, we can easily explain the effect of accenting on plural definites as they occur back in examples such as in (73c), (73d), and (74). We will look at (73d) specifically, re-listed below with the focus marking[27]:

(73d) If John talks to some partygoers, the $[\text{KIDS}]_F$ will laugh at him.

Recall that in an example such as (73d), when 'kids' in the consequent position is accented, we get the reading: "If John talks to some partygoers$_1$, the kids$_2$ amongst those partygoers$_1$ will laugh at him". What this reading implies is that there are

[27]To make things perhaps a little simpler, I assume for all the examples here that there is an accent on the entire focus exponent (e.g. the focus marked NP), instead of some syllable only.

other partygoers besides the kids mentioned in the consequent- presumably adults. The cause of this reading is explained briefly as follows: According to alternative semantics (Rooth, 1985; 1992), focus adds new semantic values to the ordinary semantic value by making a substitution in the position corresponding to the focused phrase. The added semantic values can be understood as presuppositions triggered by the focus. In (73d), when ‘kids’ is focused, we get alternative readings where different people *other than* kids will laugh at John, i.e. $[\![\ldots$ the $[\text{kids}]_F$ will laugh at him$]\!]$ = {laugh-at(x, j) | x∈C}. C is the contextual restrictor- The alternatives to ‘kids’ are individuals taken from within the contextual domain restricted by C. What this necessarily entails is that there are other people besides kids in the set of partygoers on the occasion specified in (73d). So if the definite ‘the kids’ is to bind with the antecedent ‘partygoers’, it cannot bind to those partygoers who are not kids, but only those who are kids. The same rudimentary analysis can be applied to other examples in (73c) and (74). For more detailed analysis on the disambiguating effects of accenting on definite descriptions, the readers are referred to van Deemter (1994).

3.5 The Binding Algorithm

Our discussion up to this point has spanned extensively through all the possible types of value-based matches that may hold between a definite and its potential antecedent. We have also covered accommodation and how it ought to be in the DRT framework. It is time to sum up our results and convert them into a fully functional algorithm (the kind that was exemplified in Definition 9b of Chapter 1) that can be included as an essential component of the lexical entry of ‘the’.

Our informal discussion about binding revolved around the following types of matches: Full Match, No Match, and three different types of Partial Matches. We saw that often there is a clear preference of one anaphoric resolution over its competitors, but also that there are cases of genuine ambiguity. Our method of classification exhausts all of the possible set relations that a definite presupposition may hold with a potential antecedent in context. With the exception of the genuine ambiguity category, our classification is primarily based on the values that discourse referents (of the anaphor and its antecedent) may take on, given a specific DRS in which those discourse referents appear. This is known as the value-based classification. On top of it, reference resolution can make use of a form-based approach in those cases where the value-based classification is powerless to choose between certain partial matches. Regrettably, our discussion of these two approaches does not extend to all of the available empirical data. For example, I have said very little about definite descriptions where the NP parts include compound nouns, adjuncts, relative clauses, and nothing about bridging descriptions and epithet. Constraints of space and time prevent me from extending our exploration to phrases of such syntactic complexity. Instead, I turn to two matters that have to be cleared as part of my promise to come up with an explicit proposal for the lexical entry for 'the': 1. What is the exact form of the presupposition carried by definite descriptions? 2. What form should the resolution algorithm for such presuppositions take that we want to include as part of the entry for 'the'?

Since we are interested in how to resolve the anaphoric presuppositions of definite descriptions, the challenge is to derive the most preferred resolution strategy for each and every context situation. In other words, when there is *one* potential antecedent, the resolution algorithm should be able to decide whether binding with that antecedent is preferred, or accommodation should be resorted to. In the latter case, global accommodation should be the only available type of accommodation permitted. Further, when there is more than one potential antecedent, *if* binding is preferred, the algorithm ought to be able to discern which one of the antecedents yields the most preferred reading. Finally, in cases of genuine ambiguity, the resolution algorithm should be able to generate a list of all possible readings.

There are two loose ends left from our informal discussion of examples that need to be tied up prior to composing an algorithm. One is the inability of the framework of DRT we have so far been using to keep track of which discourse conditions are introduced together with a certain discourse referent. The other is a mechanism to prioritize binding candidates with regard to their proximity to the anaphoric description. These deficits are easily mended. First, it is straightforward to mark, each time an NP that introduces a new discourse referent x into a DRS, all conditions that stem from that noun phrase as 'nominally associated with x', e.g. by simply adding to the discourse conditions an '*intro*' subscript (e.g. $\text{man}_{intro}(\text{x})$ for 'a man'). This subscript will make it possible when x is later considered as a candidate antecedent for a definite description to access the form-based match relation between the anaphor and the potential antecedent. Secondly, the potential antecedents for a given definite description need to be ranked in terms of 'nearness' to the description. Here, we must distinguish between two categories: 1. The antecedents that stems from the same sentence as the description, and 2. The antecedents that originated from an earlier sentence. Each of the antecedents of the first category counts as nearer than each of those in the second. Furthermore, within the first category, the nearer antecedents are those that are closer to the description on the accessibility path. Within the second category, nearness is just a matter of textual distance from the occurrence of the description- this roughly accounts for the influence of recency.

In principle, from the information contained in: 1. The preliminary representation of the sentence containing the definite description for which an antecedent is being sought, and 2. The context DRS obtained from the preceding sentences of the discourse- we can obtain a list of potential antecedents **PA**, arranged in terms of nearness, and where each element in the list consists of a pair consisting of the discourse referent which identifies the antecedent and the associated Value Set. Essentially, **PA** is an *ordered set*. The first element of **PA** is always the nearest antecedent (to keep track, we apply an index i, so for the nearest antecedent, i=1), and the last one farthest away (i=n). **PA** may also have sets as its members. If there are two or more potential antecedents that are equally near to the anaphor, then they are placed in the same set according to their relative nearness under **PA**. This means antecedents with the same distance/nearness to the anaphor will have the same index:

PA = $<<x_1$, VAL(x_1, $[\![K_1]\!]_{M,f}$)>, $<x_2$, VAL(x_2, $[\![K_1]\!]_{M,f}$)>, ..., $<x_n$, VAL(x_n, $[\![K_n]\!]_{M,f}$)>>

The contextual restrictor C is typically initialized to the set PA, i.e. $\{x_1, \ldots, x_n\}$, which is essentially the discourse universe that is accessible from the position of the definite trigger[28]. Depending on how seriously one wishes to take the uniqueness constraint, a resolution algorithm should first manipulate the contextual restrictor so that the definite anaphor can be *uniquely identified* from within that domain. I am somewhat ambivalent about whether uniqueness should be universally enforced, because there are certain felicitous examples like the one in (75a) where it looks as if this requirement can be suspended. Nevertheless, if we do take uniqueness to be mandatory, then we are faced with several issues as well as possible solutions. The first one that comes to mind is *recency*, which depends on a person's attention span and memory. To stipulate recency, we can place a constraint on the set of **PA** so that only the first five or ten members, or only those member with index i=1 to 5 are considered (as potential antecedents for the definite)- the exact number will depend on the size of the definite sentence, the length of the overall discourse (paragraph), how many sentences precede the one in question, the time between pauses if the discourse is uttered (instead of written), and so on[29]. Another problem we encounter when trying to recreate a contextual domain so that the definite anaphor stands unique has to do with what is called *Articulated Contexts* (Kamp, 2006). The articulated contexts, in a nutshell, is Stalnaker's common ground spelled out in DRT terms. One of the motivations behind having an articulated context is so that the notion

[28] C need not always be identified with PA, and this is discussed in Chapter 4. For the meantime, we will try to keep things simple and assume that this is the default resolution for C.

[29] The issue of recency is non-trivial, and there are many corpus based studies on coreferential recency already (e.g. Vieira & Poesio, 2000). The algorithm I intend to design should be able to incorporate the insights from these other works.

of *familiarity* (Heim, 1990) could be explained in van der Sandt's presupposition as anaphora model. More specifically, there are what is called *weakly familiar* definites (Roberts, 2003)- these definites are *discourse new*, but nevertheless entailed by the common ground, and therefore they do not *accommodate* in the typical sense of accommodation (context repair). Since it is implicit in Van der Sandt's model that the discourse context makes up the sole component of the common ground, there is very little recourse for us to account for the notion of weak familiarity- if a referent is discourse new, and discourse context is the only common ground, how do we get an entailment for its existence? Another motivation for the articulated context is the simple fact that very few definites actually require semantic uniqueness (as in Russell, 1905). 'The man' does not presuppose that there is only one man in the world, nor in the model M, but a unique man in a restricted contextual domain. This domain must be obtained from the articulated context. The question then arises 'what part of this common ground/articulated context should we consider'? Furthermore, how do notions such as salience and relevance help us obtain a subuniverse of the articulated context so that the definite is uniquely identified? These are extremely complicated questions, and we look forward to the next chapter for some answers. For the meantime, I will simply assume a resolution algorithm that takes care of finding the contextual domain in which the definite stands unique, let us call this algorithm $\mathbb{U}$.

Finally, I will use a few abbreviations for the purpose of spelling out the resolution algorithm for the existence presupposition: A single potential antecedent, ANT_i, stands for the pair $<\text{y}, \text{VAL}(\text{y}_i, [\![K]\!]_{M,f})>$, it consists of an accessible discourse referent y_i (from within the set **PA**) and its corresponding value set in the Preliminary DRS K ('i' stands for the relative distance, or nearness, of y to the anaphor). The existence presupposition of the definite is also represented in terms of a Value Set: $\text{PRES} = \text{VAL}(\text{r}, [\![[\text{C}, \text{r}|\ \text{C}(\text{r}), \text{P}'(\text{r})]]\!]_{M,f})$, where C is the contextual restrictor of the definite description, and P′ denotes the conditions associated with the descriptive content of the definite NP. Without further ado:

Definition 14, (Simplified) Resolution Algorithm for the Definite Description, $\mathbb{E}$:

(Initialize) $i = 1$

While PA $\neq \varnothing$.

If There is only one ANT_i, and PRES = ANT_i

> **Then** *Bind*, <delete> ANT_i from PA.

Else If There is more than one ANT_i, and PRES = ANT_i

> **Then** *Bind* with the antecedent ANT_i that has the *same head noun* and shares the most number of conditions marked by *intro* with PRES. <delete> ANT_i from PA.

(this takes care of Full Match)

If There is only one ANT_i, and $\text{ANT}_i \subset$ PRES

> **Then** *Bind*, <delete> ANT_i from PA.

Else If There is more than one ANT_i, and $\text{ANT}_i \subset$ PRES

> **Then** *Bind* with the antecedent ANT_i that has the *same head noun* and shares the most number of conditions marked by *intro* with PRES. <delete> ANT_i from PA.

(this takes care of Type 1 Partial Match)

If There is only one ANT_i, and PRES $\subset \text{ANT}_i$

> **If** ANT_i is specific
>
> > **Then** *Bind*, <delete> ANT_i from PA.
>
> **Else If** ANT_i is non-specific
>
> > **Then** *Accommodate*, <delete> ANT_i from PA.

If There is more than one ANT_i, and PRES $\subset \text{ANT}_i$

If ANT_i is specific

Then *Bind* with the antecedent ANT_i that has the *same head noun* and shares the most number of conditions marked by *intro* with PRES. <delete> ANT_i from PA.

Else If ANT_i is non-specific

Then *Accommodate*, <delete> ANT_i from PA.

(this takes care of Type 2 Partial Match)

If There is an ANT_i s.t. $\text{PRES} \cap \text{ANT}_i \neq \varnothing$ and $\text{ANT}_i \nsubseteq \text{PRES}$ and $\text{PRES} \nsubseteq \text{ANT}_i$

Then *Bind* and *Accommodate*, <delete> ANT_i from PA.

(this takes care of Type 3 Partial Match)

If $\text{PRES} \cap \text{ANT}_i = \varnothing$

Then <delete> ANT_i from PA.

(this will empty out all those antecedents that contradicts with the anaphor)

$i + 1$

The algorithm $\mathbb{E}$ in Definition 14 is somewhat simplified and does not fully account for all the possibilities that we have discussed so far, but in principle, it reflects the spirit of the preceding discussions. In particular, binding and accommodation of the definite presupposition follows a preference ordering as arranged by the value and form-based analysis of partial matching. i is an index that is used to keep track of which of the members of **PA** is currently under consideration. The algorithm will begin with the nearest potential antecedent (first member of **PA**) and try to resolve the definite anaphor with it. Once this is accomplished, we move onto the next one (thus i+1). This iteration will continue until all members of **PA** have been considered for resolution with the anaphor.

The way in which the algorithm works when a particular antecedent (ANT_i) is under consideration is that it will first try to obtain a value-based Full Match. And when this is not possible, the algorithm will try to obtain a Type 1 with that antecedent, if not, then Type 2, and then Type 3 Partial Match. Under each of the classifications, there are further constraints that help distinguish between multiple antecedents with the same nearness. For example, if there are two or more members of PA with the same index i (they are distanced equally from the anaphor), all of which have Full Match with the anaphor, then the one with the same head noun and the most number of matching nominal conditions (marked by the *intro* subscript) as the anaphor will be the first to bind. Upon either binding or accommodation, the antecedent (ANT_i) is taken out of **PA**. If ANT_i is incompatible with the anaphor, it is simply removed without generating a resolution reading. This process will continue until **PA** is empty.

What is implicit in this algorithm is that the output should look like a stack of all the possible readings that a definite description may have, ranked according to the order in which the algorithm $\mathbb{E}$ generates them. This ordering is consistent with the way we normally interpret definite descriptions, in the sense that binding with a nearer antecedent is always preferred over one that is further on the Preliminary DRS; binding with an antecedent that occurs in the same sentence as the definite is preferred over cross-sentential binding; binding with a Full Match antecedent is always preferred over a Partial Match; and binding with one that has the same head noun (form-based match) is always preferred under the same value-based Partial Match, and so on. Theoretically, the algorithm should be able to generate such an ordered list of different readings for a definite description, so that the relative preference between the reading can be further adjusted according to other factors, e.g. world knowledge inference, rhetorical relations, pragmatics, centering, focus articulation, etc.

3.6 The Lexical Entry for “The”

Entry 3, ‘the’ for definite NPs:

$$\lambda \mathrm{P}' \ \lambda \mathrm{P} \ \left(\left\langle \left\{ \boxed{\begin{array}{c} \mathrm{C} \quad u \\ \\ u = \Sigma \ u. \ \boxed{\begin{array}{c} \\ \mathrm{P}'(u) \\ \mathrm{C}(u) \\ \end{array}} \\ \\ \mathbb{U}, \ \mathbb{E} \end{array}} \right\}, \boxed{\begin{array}{c} \\ \\ \\ \end{array}} \right\rangle \oplus \mathrm{P}(u) \right)$$

It should be noted that while $\mathbb{U}$ and $\mathbb{E}$ are part of the lexical entry for ‘the’, they are *not* technically DRS conditions. They are not for some very obvious reasons: The utilization of Value Set (VAL) requires us to have an overview of what is in the Preliminary DRS, and what is in the Model of interpretation for such DRS (here assumed to be $\mathcal{M}$). Neither of these information can be made available from the point of view of a discourse condition. Furthermore, operations such as *Bind* and *Accommodate* belong to a very different class of concepts from standard discourse conditions, and they cannot be concocted through manipulating discourse conditions alone. Likewise, it is impossible to perform form-based matching of head nouns and nominal conditions using discourse conditions. From a computational point of view, instructions specified in $\mathbb{U}$ and $\mathbb{E}$ are written in a *meta-language* and performed by an external Artificial Intelligence completely independent from the semantic representation of the lexical entry. The way it works, figuratively speaking: $\mathbb{U}$ and $\mathbb{E}$ will remain “dormant” in the lexical entry of ‘the’ until the syntax-semantic construction is over. After that, they will "spring into action" and start resolving the presuppositions in the Preliminary DRS that the definite which "houses" them is responsible for. And as usual, we always begin our resolution with the innermost presupposition, and work our way out.

3.7 Concluding Remarks

Our theory would be very unrealistic if the predictions of our value and form-based analysis have no correlations at all with data-driven, empirical studies done on the same topic. As a final remark, I would like to briefly relate to an automated heuristic developed by Vieira and Poesio (2000)[30].

Vieira and Poesio's heuristic processes parts of the Penn Treebank corpus with the goal of locating coreferential antecedents for definite descriptions. The outcome of the heuristic is then passed onto human annotators and verified for its accuracy. The focus of this chapter has been on the anaphoric role of definite NP's, while relatively little was said about its secondary function: Introducing a discourse new referent via accommodation. More ought to be said about the projecting behavior of definites as Vieira and Poesio (2000) suggests. In their experiment where segments of the *Wall Street Journal* were processed according to schemes derived from Hawkins (1978) and Prince (1981), they discovered that in daily newspaper usage, definite descriptions are *not* primarily anaphoric; *half of the time they are used to introduce a new discourse entity*; only 28.27% were cases of direct anaphora- what is regarded as *binding* throughout this chapter; and 15.38% were bridging descriptions. This puts into question one of van der Sandt's primary hypothesis that binding should have priority over accommodation.

[30]There are a number of works done on pronominal anaphora resolution in NLP and computational linguistics, e.g. Lappin & Leass (1994), Ruslan (1998), etc. For lack of space I will only take one that I see as being the most relevant.

When binding, the first thing that the heuristic does is to *match the head nouns*. When matching a definite description with some potential antecedent, the information provided by the prenominal and the postnominal part of each of the NPs are taken into account. e.g. ‘a blue car’ may not be identified with ‘the red car’, nor ‘a house on the left’ with ‘the house on the right’. This corresponds closely to our observation that form-based matching should never be applied to anaphor-antecedent pairs without satisfying some form of value-based Partial Match first. Typically, in order to discern whether a noun with modifiers may serve as an antecedent for a definite with the same head noun, some common sense reasoning about world knowledge is required. Vieira and Poesio (2000) proposes a simple word pattern matching for the heuristic to accomplish this task: If the premodifiers of the definite description is a subset of the premodifiers of the antecedent, then their discourse referents are identified, e.g. “an old Victorian house…the old house”. This procedure is entailed by our choice of binding over accommodation in cases where the anaphor is less informative than the antecedent (Type 1). Interestingly, Vieira and Poesio (2000) also included tests when the antecedent premodifiers are subset of the definite description premodifiers, in other words, when the anaphor is more informative than its antecedent. Slightly more accurate predictions (about 3% improvement) were produced by the heuristics when the algorithm prohibits the definite from adding new information to its antecedent. Once again, this is consistent with our own observation about how non-specific antecedents in a Type 2 Partial Match are unsuitable binding candidates, and how even specific antecedents can be ambiguous if it lacks a form-based match with the anaphor.

There is a great deal of work done on *segmentation* and *recency* in Vieira and Poesio (2000). A set of potential antecedents is always restricted by their limited life-span, that is, discourse referents in a context can only serve as an antecedent for a definite description within some pragmatically determined segments (see, e.g. Reichman, 1985; Grosz & Sidner, 1986; Fox, 1987). This point was mentioned earlier in this chapter when we tried to determine the algorithm for uniqueness and contextual restriction ($\mathbb{U}$). In Vieira and Poesio (2000), “segmentation” is the limiting of accessibility of discourse referents. An indexed table is also kept to keep track of the heads of all potential antecedents. A definite NP will have the index of the last occurrence of some antecedent with the same head noun. This is done without any restrictions on the distance to the antecedent. This latter method is called "recency"[31]. A combination of segmentation and recency is applied, and the best precision is achieved (91.21%) when four sentences are set to be the window size of segmentation, and when recency is applied. In theory, these two techniques can be quite readily incorporated into our resolution algorithm $\mathbb{U}$.

Generally speaking, the criteria used in this chapter to determine Partial Match is in line with the empirical methods mentioned in this section. Specifically, the value-based and form-based approach both find their way into the heuristic design, in ways that correlate closely to our own resolution algorithm. Perhaps the most surprising insight gained from Vieira and Poesio (2000) is the enormous number of occurrences of discourse new definites. Does this in anyway refute van der Sandt's claim that binding should be preferred over accommodation? To answer this question, we will have to turn to the next chapter.

[31]Note that the term 'recency' is used throughout this chapter to refer to Vieira and Poesio's notion of segmentation.

Chapter 4

Superlatives, Ordinals, and Articulated Contexts

Due to the limited space available, one more case study will be presented here to endorse the lexical perspective that was argued for in Chapter 2. As we have already seen, the tasks of drawing up a proper semantic representation for the definite NP, as well as the composition of a context-sensitive resolution algorithm for its presuppositions, are far from trivial. Lexical presupposition triggers, or *words*- whether our goal is to understand their semantic content and internal structure, or to define a set of contextual constraints that will help isolate the set of contexts which admit these words- the only way to achieve either of these goals is to study the words themselves. In this chapter, we will be concerned with the construction of semantic representations of utterances involving superlatives and ordinal number phrases, using the framework of Discourse Representation Theory (DRT) (Kamp & Reyle, 1993). I will describe the constructions of semantic representations, in the form of Discourse Representation Structures, for sentences involving superlatives and ordinals. An important part of this task is the specification of the relevant lexical entries for the superlative operator '-est', and the ordinal expressions 'first', 'second', 'third', etc, as well as the contribution these entries make to the overall superlative and ordinal phrases ('the highest mountain', 'the first/second/third time', 'the 26_{th} highest mountain'). A crucial aspect of both superlatives and ordinals is the presuppositions they trigger. Representations of these presuppositions will be built as part of the compositional process of DRS construction. As in van der Sandt (1992), presuppositions are resolved in context only after the preliminary representation in which they are explicitly represented has been constructed. However, I will modify van der Sandt's resolution procedure by extending his notion of 'contexts'. Essentially, the contexts we will work with is to include also information that has not been expressed in the antecedent discourse. Such contexts can be seen as a way of articulating the concept of common ground (Stalnaker, 1974).

4.1 The Dynamics of Discourse and Context Building

Central to our discussion is the treatment of presupposition. The treatment I adopt takes as its point of departure the account developed by van der Sandt, which is best known through its presentation in van der Sandt (1992). Van der Sandt proposed that presuppositions be seen as closely analogous to anaphoric pronouns as treated in DRT: both anaphoric pronouns and presuppositions can be seen as conditions imposed on the context; If the context does not satisfy the condition and cannot be accommodated so that it comes to satisfy it, then the utterance which triggers the condition cannot be given an interpretation. On this view anaphoric pronouns and the presuppositions familiar from the presupposition literature (Karttunen, 1979; Heim, 1990) become sub-cases of a single phenomenon. These considerations led van der Sandt and Geurts to a general revision of the architecture of DRT, in which interpretation of a sentence S first yields a *Preliminary DRS*, where all presuppositional conditions imposed by S are explicitly represented. In a second step, these presuppositional conditions are then verified in the context and the context is accommodated to the extent this is wanted and within the scope of possibilities.

This revised architecture differs crucially from that which had been widely assumed as standard until that time (Kamp & Reyle, 1993). It is adopted in Kamp, Reyle and van Genabith (2008), and it is this version which I will take as point of departure.

According to this new architecture, the processing of multi-sentence text proceeds as follows: Processing of the first sentence S_1 from a text $<S_1, S_2, \ldots, S_n>$ yields a Preliminary DRS K_1'. The presuppositional conditions represented in K_1' are checked against the initial discourse context K_0, and if this is successful (either through binding with an antecedent or accommodation in K_0), the remaining, non-presuppositional part of K_1' is merged with K_0, leading to a new discourse context K_1, which captures the contributions made by S_1 while also serving as the discourse context to the next sentence S_2.

The first of the two stages, presupposition computation, is part of the syntax-semantic interface; while the second, presupposition resolution, is part of the semantic-pragmatic interface. There have been some attempts to account for the manifestations of these two interfaces (Kamp, 2001a), yet given the complexity of the task and the many different data that are to be accounted for, there are still many aspects of the theory needing articulation.

4.2 the Meaning of Superlatives and Ordinals

Each lexical entry should make the correct contribution to the DRS of an utterance where the subsequent word appears. This includes presuppositions that the word triggers and also the ways in which these presuppositions may be resolved. I will be looking at the interaction between ordinal and superlative words, as in the 'n_{th} highest mountain' in (82).

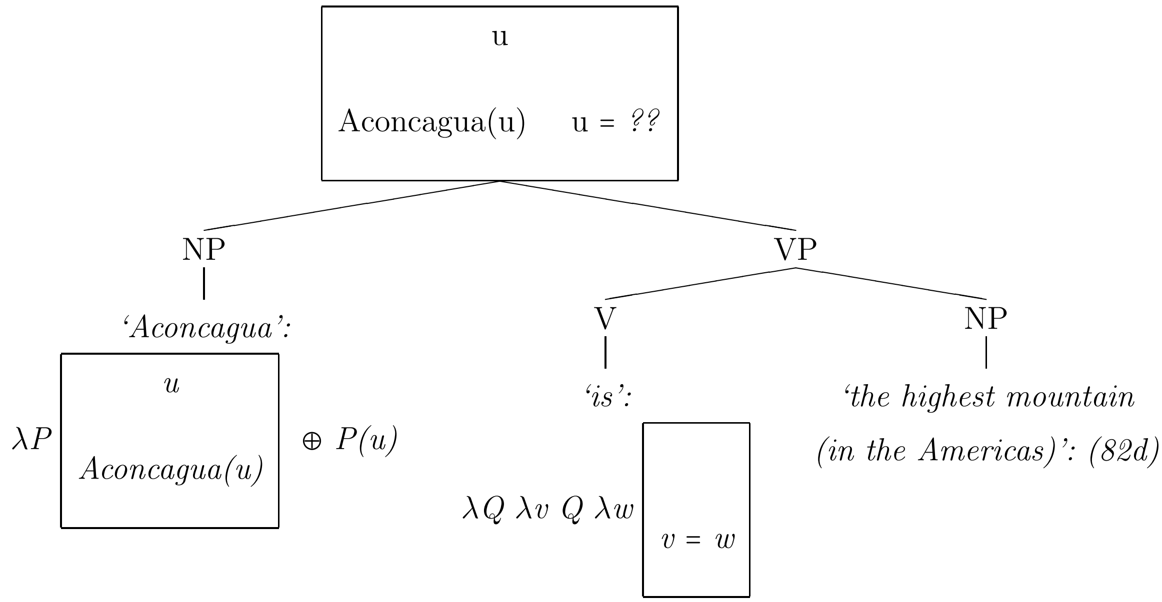
(82) a. Standing at 6962m, Aconcagua is the highest mountain in the Americas.

b. (However,) it is (only) the 26_{th} highest mountain in the world.

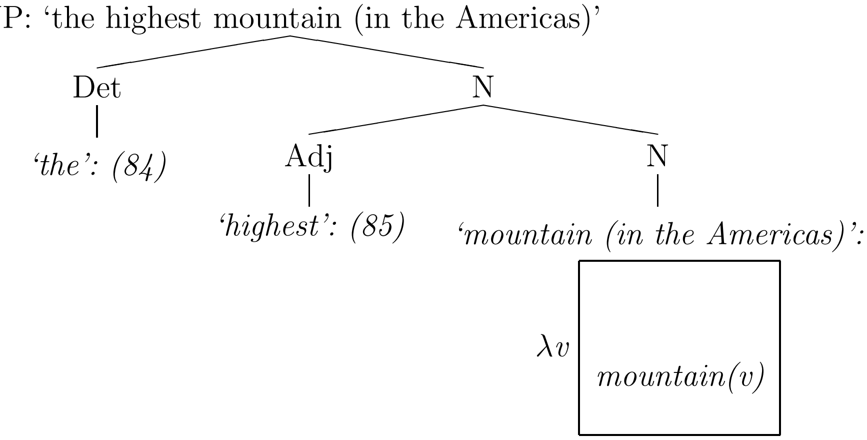
To show that our intended lexical entries comply with the syntax-semantic interface that was outlined in the previous chapter, the Box + λ syntactic structure for the superlative sentence is also illustrated in (82c) and (82d):

(82) c.

S: "Aconcagua is the highest mountain in the Americas."



(82) d. NP: 'the highest mountain (in the Americas)'



In order to determine the truth condition of a simple clause containing a DP of the form 'the n_{th} N' (or 'the n_{th} P_{est} N'), we need a contextually relevant *set of entities* that are extensions of N. This set must have a cardinality of *at least* n. We will also need a partial order ≤ between the members of this set, such that the set is well ordered and linear. Under these premises, (82a), as a case of superlative, is uttered against a background of a linearly ordered set of mountains, all if which are geographically located in the Americas. Here, a binary ordering relation (≤) can be retrieved from the meaning of the superlative 'highest'. This ordering by height is applied to the set of mountains in the Americas such that the highest mountain is singled out and identified as Aconcagua. As for (82b), a case of superlative ordinal, it seems that not only there is a set of linearly ordered mountains being compared with regard to their height, but it is necessary that there are *at least* 26 mountains in the world in order for the utterance 'the 26th highest mountain in the world' to be felicitous. How these 26 mountains are represented in our framework, and whether they are 'presupposed' in the traditional sense of e.g. van der Sandt (1992), is discussed in the following sections. For the moment, let us just assume that when a sentence with the clause 'the n_{th} N' (or 'the n_{th} P_{est} N') is true, it 'presupposes' a set of n many N's, linearly ordered by $\leq_P$. Let 'b $\leq_{high}$ a' stands for 'a is at least as high as b', the semantic structure for (82b) is illustrated as follows:

$$\ldots \leq_{high} \boxed{mountain_{27}} \leq_{high} \underset{\substack{\uparrow \\ \text{“Aconcagua”}}}{\boxed{mountain_{26}}} \leq_{high} \boxed{mountain_{25}} \leq_{high} \ldots$$

Figure 1, Graphic illustration of the meaning of 'the 26_{th} highest mountain'

4.3 Articulated Contexts

In this section I argue that the linearly ordered set of N's 'presupposed' by the clause 'the n_{th} N' is *not* actually presuppositional, and also that an extension of the current theory of DRT is needed in order to account for the proper expression of the semantics of superlatives and ordinals. In addition, even though they are not presuppositions in the traditional sense, the DRT mechanism for treating presuppositions as anaphoric expressions may equally apply to them given an extended notion of context. Consider the following examples:

(83) a. God blessed the seventh day and made it holy, because on it he rested from all the work of creating that he had done.

b. ? John came on the seventh day and…

c. ? The third student's name is Ralph.

d. A: Where is the vinegar?

B: It's in the third (from the top) drawer (of the closet next to you).

In order for (83a), a passage from the Bible, to be correctly understood, 'the seventh day' cannot be taken as a day on its own, for without some connection to the other days there would be no way of assigning an interpretation to the ordinal 'seventh', and its contribution to the interpretation of (83a) would come to nothing. For noun clauses of the form 'the n_{th} N', there is typically a set of at least n N's, such that they are linearly ordered by some binary relation $\leq_P$, and P is given by the adjective or entailed from the NP. In this example, $\leq_P$ is the temporal precedence relation, since according to our general world knowledge, days are linearly ordered in time. Each day d_2 is immediately preceded by a day d_1, and immediately followed by another day d_3 [1]. However, a set of days and the ordering relation alone are not enough for the interpretation of the ordinal. We must also have a first element in the extension from which elements can be counted as 'first', 'second', etc. In the case of (83a), there is a set of at least seven days, of which is the first is given by the Biblical story of creation. But in the case of (83b), a set of days one of which can be identified as the first day must be recoverable from the particular context where the sentence is used, and here such a context is missing. Hence our helplessness when we try to interpret (83b).

These considerations point towards two conclusions: 1. A phrase of the form 'the n_{th} N' presupposes some ordering $\leq_P$ on the extension of N; 2. It also presupposes some contextually recoverable subset C of N within which the order $\leq_P$ is well founded (so that we can count the members of C as 'first', 'second', etc, in accordance with

[1]In DRT, successive days are represented by the abut symbol ⊃⊂, so we have $d_1 \supset\subset d_2 \supset\subset d_3$I will simply take the conventional view of calendar days, where a day ends by midnight, and the next day begins. This is an appropriate interpretation of the meaning of 'day' when it is used with an ordinal.

$\leq_P$). The case where N is 'day' is special, we saw in that the extension of 'day' comes with a natural temporal order as far as presupposition 1. is concerned, and our general world knowledge will be enough to satisfy it. But presupposition 2. cannot in general be resolved on the basis of general knowledge alone. (83a) is special in that it points towards some particular sources of knowledge about Judaeo Christian scripture which supplies a particular set of days, with a first, second…seventh element. No such pointer comes with (83b). Resolving presupposition 2. for an occurrence of (83b) must therefore rely on other aspects of its context, for instance, some set of days that has been mentioned previously.

It was said that a phrase of the form 'the n_{th} N' presupposes some ordering $\leq_P$ on the extension of N, but what precisely is this ordering between the students in (83c)? In addition, what are the contexts in which (83c) can be felicitously uttered? The answer is that there are many such contexts. For example, a context where the interlocutors see a group of students waiting in line, or a context where a number of students arrived in the class at different times, or students each earning a different grade for their exams, etc. Each of these contexts will result in a different $\leq_P$ as well as a different subset of the extension of students where $\leq_P$ is well founded. One must look for the precise meaning of $\leq_P$ from the relevant context in which (83c) occurs. My observation is that not only the discourse context, which represents the content of the preceding text/discourse, provides the contextual information needed to resolve the presuppositions carried by an utterance, but also our general knowledge about the material, social and cultural world, as well as *the particular context of the conversation of which the utterance is part*, all play important roles in presupposition resolution. A theory of presuppositions should take into account *all* contextually available resources, as opposed to previous theories that treat presuppositions as anaphoric expressions, such as van der Sandt (1992) and Kamp (2001), where the discourse context is the only place in which the antecedents for presupposition justification is sought.

As soon as we begin to utilize contextual resources beyond the discourse, many presuppositions previously considered as needing accommodation disappear. To give an example, it was observed in Vieira and Poesio (2000) that roughly 50 percent of definite uses in daily life are for the purpose of introducing new discourse referents, which under van der Sandt's theory calls for accommodation. This overwhelming proportion of discourse new uses of definites is rather unexpected because in his theory, accommodation is meant as a repair strategy that corrects a 'deficient' context- by adding the information that helps resolve the presupposition of the given description. According to this theory, accommodation is a last resort, which suggests that the tendency for anaphoric definite usages should be more prevalent than discourse new usages. An explanation for what seems an excessive proportion of discourse new occurrences in the data is that perhaps not all such definite descriptions should be considered candidates for genuine accommodation. For Heim (1982), the distinction between definites and indefinites is that definites presuppose *familiarity*, while indefinites do not. The familiarity presupposition is the presupposition that the referent is already familiar to the recipient and can be identified by him on the basis of some information he has at the point where he has to interpret the description. In other words, there is already information corresponding to the familiar definite description in the local context of interpretation. What is meant by 'context' here is characterized as a store of information held in common by the interlocutors, a version of Stalnaker's (1974) *common ground* (this is explained in great detail and formalized in Definition 4 of Chapter 1). The notion of common ground includes not only information that is given by the text, but rather, as I have argued, *all* contextually available resources. To utter a familiar definite is to bring to attention something that already exists in the common ground but not in the immediate center of attention. Definite descriptions which are *completely unfamiliar* are the only ones that should rely on accommodation. This conclusion is reinforced by Vieira and Poesio's experimental data. Roughly 31% of the discourse new definite occurrences can be classified as references to entities in the common ground, or entities that can be easily identified with knowledge from the common ground- 7% of these are definite uses that are new in the text but can be deduced from the discourse through identifying head nouns (e.g. 'the cigarette filter', referring back to 'a filter'), or bridging descriptions based on simple reasoning with world knowledge and knowledge about the meaning of words (e.g. 'the morbidity rate' related to a prior 'total of deaths', 'the details of the spinoff' related to a prior 'documents'); About 24% of the cases of discourse new definite usage in the corpus refer directly to something in the common ground (e.g. 'the 1950s', 'the U.S.', 'the pope', what Hawkins (1978) would call 'larger situation' definites). Once we eliminate these 31% of the discourse new definite occurrences, we are left with a much more plausible portion of genuine accommodations. A referent is familiar because it is in the common ground, even though it might not be explicitly uttered in a prior discourse (the case of *weak familiarity* according to Roberts (2003)). But what exactly constitutes *familiarity*? What does the common ground look like in our theory?

The notion of familiarity is explicitly spelled out in DRT terms by an *articulated contexts* (Kamp, 2006). The Articulated Contexts is a quintuple of distinct but interacting components, each represented by a DRS:

the Articulated Contexts

$<K_{Dis}, K_{Gen}, K_{Env}, K_{Utt}, K_{Env}>$, where

K_{Dis} is the discourse context. This is the traditional DRT notion of 'context'. Everything that has been said so far in the given discourse gets stored in this context.

K_{Gen} is the general knowledge context. Similar to the TBox in AI, it is a store of general knowledge about the world. One can see it as a store of words and their ontological relations, much like that of WordNet, or more complex knowledge representations like OWL ontologies or FrameNet. The representation of K_{Gen} would be a DRS lacking discourse referents in its main universe, but only certain general knowledge in the form of either conditional or duplex conditions. An example of general knowledge would be "All humans are mortal".

K_{Enc} is the encyclopedic context. Similar to the ABox in AI, this is a store of information about particular entities of various kinds: names, people, artifacts, places, events, etc. An example of an item in the encyclopedic knowledge would be the representation of a man named Socrates (which verifies the statement: "Socrates is a human"), together with some of his better known properties, such as that he was a citizen of Athens in the 5_{th} century BC, that he was a philosopher, that his most famous student was Plato, etc.

K_{Utt} is the utterance context. It only contains elements that are associated with the given utterance, specifically: the speaker, the utterance time and the addressee (if there is one). Other elements such as the location where the utterance takes place could be included as needed.

K_{Env} is the environment context. This component contains information about the objects and events that are perceptually accessible to the interlocutors.

The dialogue in (83d) illustrates how interpretation of utterances rely on resources found in the common ground represented by an articulated context. First of all, the 'drawer' refers to something in the immediate environment accessible to both A and B. This means the referent for the particular drawer should be found in the environment context K_{Env}. The definite determiner in 'the third drawer' will trigger an existence and uniqueness presupposition, only to bind with that referent taken from K_{Env}. Second, drawers are understood as arranged in a certain order, this knowledge comes from the general knowledge K_{Gen}. One of the many functions of the general knowledge context is storing selectional restrictions, meaning postulates, etc. Third, 'the drawer of the closet next to *you*' involves a reference to the addressee A. The referent of this phrase will presumably be available to A from K_{Utt}, which will enable him to interpret 'you' as referring to himself. Fourth, 'from the top' of what? K_{Gen} tells us that drawers don't just exist on their own, they are usually part of a bigger piece of furniture. When 'of the closet next to you' in parentheses is not explicitly stated, this question can only be answered if one looks into the immediate surroundings of the dialogue (K_{Env}). Alternatively, A may accommodate the existence of the closet on the basis of information in K_{Gen}, according to which closets often have drawers. In the former case, the interpretation of the entire phrase "the third drawer from the top of the closet next to you" will be identifiable on the basis of K_{Utt} and K_{Env}. In the latter, K_{Gen} will be involved as well[2]. The drawers in the closet are arranged in a vertical order, and that the closet has at least three drawers, must of course be accommodated in this case. Finally, B's use of 'it' involves the discourse context K_{Dis}: 'it' is an anaphoric expression that refers back to the vinegar that was uttered by A. This presupposition can be treated using the familiar van der Sandtian approach where the pronoun discourse referent identifies with an antecedent that is already in the discourse context (K_{Dis}). Binding constraints should ensure that 'it' does not bind to the drawer or to the speakers.

The common ground is decomposed into those five interacting contexts for various reasons: Certain components can be defined with great precision. Take the notion of utterance context K_{Utt} for instance, indexicals such as 'I', 'you', and 'now' are reserved exclusively for the speaker, the addressee, and the utterance time. This analysis of the utterance context is most well known in Kaplan's *Demonstratives* (1989), but can also be found in earlier works by Russell and Reichenbach. Another context that admits precise definition is the discourse context K_{Dis}. Interpretation of a sentence

[2]In the event that such a closet is neither specified by B nor perceived by A, i.e. not part of the common ground $\mathrm{K}_{Dis}/\mathrm{K}_{Env}$, A is forced to accommodate *something* that has drawers in it. This thing does not necessarily have to be a closet, but a piece of *underspecified* furniture/object which has an assortment of drawers.

in an ongoing discourse often depends on the information given by the preceding sentences. One of the principle claims in the original formulation of DRT was that K_{Dis} as a cumulative store of such information allows the interpretation of cross-sentential anaphoric pronouns. There are two important differences between K_{Utt} and K_{Dis}. First, the discourse context is essentially dynamic. When a new sentence S_0 is interpreted with a discourse context K_0, the outcome of this interpretation is integrated into K_0 to produce K_1. K_1 reflects the contribution made by S_0 as well as all the sentences before it, and serves as the context of the next incoming sentence S_1. Second, utterance context is *extra-linguistic*. It consists of entities which are connected with the making of the given utterances. These entities are part of the world or situation in which the utterance occurs. Discourse context, on the other hand, represents exclusively what is said or written, which relates strictly to linguistic content or linguistic form.

There are many words and linguistic phenomena that rely exclusively on one or two of the five components of the articulated context. A demonstrative expression such as '*this* NP' or '*that* NP', *here* or *there*, identifies either a referent already mentioned in K_{Dis}, or a relevant representation in the environment K_{Env}; Proper names, in van der Sandt's theory, assumes that there is a representation for the name bearer in the discourse context. When this is not the case, proper names are considered presupposition triggers and accommodation takes place at the global DRS, even in cases where the interlocutors are familiar with the name bearer. This is reminiscent to our complaints earlier regarding the excessive occurrences of discourse new definites (Vieira & Poesio, 2000)- many of them are no longer genuine accommodations given the articulated contexts. Often a proper name invoked in a conversation is already known to the interlocutors, although it hasn't been explicitly mentioned during the conversation (or in the text). It may be the name of a famous place ('White House'), person ('Elvis') etc, or simply of a friend or relative of someone involved in the dialogue- articulated contexts allow us to *transfer* the referent denoting the familiar proper name from the encyclopedic context K_{Enc} to the discourse context K_{Dis}. This will allow the referent of the proper name to be available to pronouns later[3]; Speech acts often impose felicity conditions in order that the speech act can achieve its purpose. These felicity conditions can be satisfied by checking the environment context K_{Env}[4]. Bridging tends to rely on our general and encyclopedic knowledge about the world (K_{Gen} and K_{Enc}). Even though the existence presupposition of definite descriptions tends to be unselective as to the articulated context component in which it finds its antecedent, the uniqueness presupposition often comes from strict generalizations primarily found in K_{Gen}. Take Russell's King of France example, according to our general knowledge, there can be only *one* King. The same should apply to superlatives, and ordinals as we will see in the following sections.

From the point of view of this chapter, the task of constructing the semantic representation of a given discourse is the same as the task of building up the common ground in the form of articulated contexts. Information only enters the common ground when all the participants of a discourse know and agree on it. Anything that is privy to one participant is not considered part of the common ground. New information gets added to the common ground through an utterance, either

[3] *Transfer* is a concept that should be given some details here. When a proper name is uttered, a discourse referent denoting the proper name is introduced into K_{Dis}. If the addressee is familiar with the person/object in which the proper name denotes, then the representation for this proper name can be found in K_{Enc}, the two are then identified with one another. The referent of the name in K_{Dis} becomes anchored to the same entity in the actual world M_{w0} as the referent of the same name in K_{Enc}. In this chapter, our primary focus in terms of how the components of articulated context interact will be on the transfer of information into K_{Dis} from the other components.

[4] Speech act is a communicative activity defined with reference to the intentions of the speakers while speaking and the effects they accomplish on the listeners. Some examples are, a Directive such as "A: will you give me a dime?", or a Commissive, such as "B: I will give you a dime". Both of which carry the precondition that the addressee of the Directive, B, who is also the speaker of the Commissive, carries a dime with him. This condition can be satisfied if it is the case that in the situation in which the utterance takes place, B has a dime. This is not the only case in which the felicity condition is satisfied however, since there may not be a dime after all and yet both interlocutors believe that there is one in the possession of B. I will not delve too much into the details of speech acts at this point.

because it is directly asserted or as a presupposition that needs accommodation. My basic premise here is similar to that of Stalnaker (1998). Speakers tend to take lots of familiar facts for granted, and tend to assume that everyone already knows them when engaged in a conversation. For Stalnaker, information that defines the context can be represented as a set of possible worlds, known as the *context set*. My main goal is to spell out how common ground representations are built as a discourse unfolds. My focus will be on the contributions made by particular words and morphemes: the definite determiner, the superlative morpheme '-est', and the ordinal words 'first', 'second', and so on.

4.4 the Definite Determiner

The ordinal expressions in all of the examples so far have been definite descriptions. Therefore the meaning contributions from the definite determiner 'the' cannot be ignored. Since we have already discussed in great detail the presuppositional contributions of the definite and the resolution constraints associated with that particular trigger, a somewhat more simplified and more 'transparent' lexical entry for the definite determiner 'the' is perhaps expedient for our current pursuit[5]:

(84) (singular) 'the': $\lambda P' \, \lambda P \left(\left\langle \left\{ \left\langle \left\{ \boxed{\begin{array}{c} \underline{C} \quad u \\ \\ P'(u) \\ C(u) \end{array}} \right\}, \boxed{ \boxed{\begin{array}{c} v \\ \\ P'(v) \\ C(v) \end{array}} \; \underset{\text{all}}{\overset{v}{\Diamond}} \; \boxed{\begin{array}{c} \\ v = u \\ \\ \end{array}} } \right\rangle \right\}, \boxed{} \right\rangle \oplus P(u) \right)$

[5] I have eliminated the resolution algorithm from this version of the lexical entry and only present the semantic representation here. The reason is because I would like to *reconsider* those tasks involved specifically for the definite superlatives and ordinals.

The above lexical entry consists of a Preliminary DRS with the two presuppositions enclosed within the curly brackets, one nested within the other. The outer curly bracket contains the DRS for the uniqueness presupposition on the right hand side. P′ represents the descriptive content of the descriptions and P represents the descriptive content of the predicate to which the description is an argument phrase. The innermost DRS is the representation for the existence presupposition, and the contextual restrictor C where the definite is to be identified. Existence and uniqueness presupposition for singular descriptions must allow for contextual restriction (von Fintel, 1994). In (84), this contextual restriction is represented in the form of the predicate C. The underlining of C indicates that C is anaphoric, and that the context *must* provide a suitable value for it[6]. Like anaphoric pronouns, C is to be identified with some contextually salient entity/set of entities in such a way that the interpreter is able to see the contextualized existence and uniqueness presupposition as fulfilled. Exactly how this is done is discussed in the following section. In a framework of articulated contexts, one of the context components must be selected before C can be identified with the universe of that particular context component.

Note that the entire presupposition structure in (84) (between the outer curly brackets) represents the existence and uniqueness presuppositions. It does so in a slightly unusual form in that the existence presupposition is 'hidden' in the subordinate presupposition (within the inner curly brackets), which is resolved by determining a value for the contextual restrictor referent C. The constraint on C is that there must be at least one thing falling under C which satisfies the overt descriptive content of the description. In other words, during the presupposition resolution phase there must be a referent in the selected context component DRS such that it satisfies P′. The uniqueness condition is expressed in the main presupposition, i.e. in the DRS on the right of the embedded presupposition concerning C. This guarantees that it will be the only entity satisfying both P′ and C.

[6]The underlining of C signals that it is a resolution algorithm similar to $\mathbb{E}$ and $\mathbb{U}$ that are found in Chapter 3.

4.5 Superlatives

A definite NP is not only uniquely identified in one of the components of the articulated context. If and when identification succeeds, it must also be represented in K_{Dis}, for otherwise it could not be explained how pronouns occurring in subsequent utterances can refer back to the description once it has been introduced. This much is true for any singular definite descriptions. But descriptions which contain ordinal/superlative expressions are special in that these expressions contribute some further presuppositions: There is a unique set in the context called the *comparison set* (Bos & Nissim, 2006). This comparison set consists of entities in the extensions of the common noun phrase to which the superlative is left-adjoined. Furthermore the comparison set must be ordered (for simplicity at this point, we will assume that the ordering is linear) by some binary relation (e.g. height). This relation- the so called *comparison dimension*- is generally determined by context. However, in cases where the ordinal NP also contains a superlative, as in ‘the 26th highest mountain’, the order is identified with the comparison dimension of the adjective, e.g. ‘high’. For ‘the n-th wealthiest person in the world’, the members of the comparison set are all the people in the world, as stated by the utterance, and the comparison dimension is the level of their wealth; ‘the n-th most talented child’ compares a set of children in a salient context with respect to their talent. For (82a), the set of mountains in the Americas would constitute the comparison set for the second sentence, and the set of mountains around the world would constitute the comparison set for (82b), while the comparison dimension is height.

There are primarily three types of expressions that concern us- Superlatives, Ordinals (‘the third student’ as in (83c)), and Ordinal Superlatives (‘the third highest mountain’). The distinction between pure ordinal expressions and ordinals used in combination with a superlative is that pure ordinal expressions require the interpreter to recover the comparison dimension from context, while ordinal superlatives make this explicit. This difference is important during the presupposition resolution phase. Throughout this article I will refer to these expressions as **S-NP** (for Superlative expressions), **OS-NP** (Ordinal Superlatives), and **O-NP** (Ordinals). These terms are not to be confused with the use I will make of the word *superlative*, which only refers to the superlative adjective, and *ordinal*, which refers to the ordinal adjective.

I argue here that the semantic representations of O-NP and OS-NP are based on the semantics of S-NP, and an investigation of the former should begin with the latter. Intuitively, S-NP's should have the same semantic content as the very first of the OS-NP. '*The first highest mountain' has the same meaning as 'the highest mountain', the '*first earliest time' is the same as 'the first time' (as entailed by the meaning of the word 'time'), and so on. Furthermore, ordinals in general can be used to modify a S-NP, as in (82b). In (82b), the superlative merely makes clear what the comparison dimension is, but it is the ordinal that specifies the relative placement of the referred mountain in the list of mountains around the world. Another feature that O-NP/OS-NP and S-NP share is that they are both ambiguous between a comparative reading and an absolute reading (Szabolcsi, 1986; Heim, 1999). All this suggests that we begin the investigation of the semantics of ordinals by looking at the superlatives.

Following the footsteps of many others (Heim, 2004; Cresswell, 1976) and extending the previous notion of comparison dimension, I will assume in the case of comparative NP's/S-NP's, that their adjective stems express a relation between an object and a degree. So for example: height(x, d) means object x has a height of degree d. Assuming degree for height is measured in meters, the first sentence of (82a) provides us with an instantiation: height(Aconcagua, 6962m)[7]. In addition, if 'x is higher than y', then $d_x > d_y$. Degrees of unaffixed adjectives are downward monotonic:

> A relation R between objects and degrees is downward monotonic iff
> $\forall x \forall d \forall d' (R(x,d) \wedge d > d' \rightarrow R(x,d'))$

According to the above convention, if Aconcagua is 6962m high, it is also (at least) 6961m and (at least) 6960m high, and so on, but it is not 6963m high. It follows that

[7]The quantification over degrees approach for superlative and comparative expressions can be found in (Heim, 2004) and (Gawron, 1994), amongst many others.

if another mountain is higher than Aconcagua, then it must also be (at least) 6962m high, in addition to being high to a degree that Aconcagua is not. To be the 'highest' then means 'having a degree of highness such that nobody else in the salient context has it'. This *salient context* is represented by a contextual restrictor C. A superlative *R-est* then, has the following semantics:

$$\textit{R-est}(\mathrm{x, R, C}): \exists \mathrm{d}(\mathrm{R(x,d)} \wedge \forall \mathrm{y}(\mathrm{y} \neq \mathrm{x} \wedge \mathrm{y} \in \mathrm{C} \rightarrow \neg \mathrm{R(y,d)}))$$

I begin with a preliminary semantic representation for the word 'highest' in singular definite superlative descriptions/SS-NP (e.g. 'the highest mountain'). A (definite) S-NP inherits the contextual restrictor of its determiner, so the C below is really a contribution from the definite. It is essential that this contextual restriction becomes part of the lexical entry of a superlative:

(85) '(the) highest':

$$\lambda Q\ \lambda u\left(\left\langle \left\{ \left(\boxed{\begin{array}{ll} \underline{\underline{C_{Art}}} & X \\ & \\ C^{*}{}_{Art}(X) & \\ |X| \geq 2 & \end{array}} \oplus Q^{*}(X)\right)\right\}, \boxed{\begin{array}{c} d \\ \\ high(u,d) \\ u \in X \\ \left(\boxed{\begin{array}{c} y \\ \\ y \in X \\ y \neq u \end{array}} \oplus Q(y)\right) \Rightarrow \boxed{\neg \boxed{\begin{array}{c} \\ high(y,d) \end{array}}} \end{array}} \right\rangle \oplus Q(u)\right)$$

X is a discourse referent for a set. The operator $*$ transforms a predicate P of individuals into one that is true not only of individuals but also of collections consisting exclusively of individuals of type P[8] (Link 1983). So the set denoted by Q^* can be either a singular element of M or a set of members of M, all of which satisfy the condition Q. Q is obtained through β-conversion in the Box + λ construction, and is identified with the descriptive content of the adjoining noun.

[8]For details, see Chapter 4 of Kamp & Reyle (1993).

The part within the curly brackets in (85) is the 'presuppositional' part of the superlative 'highest', it is a representation of the comparison set X, a set of minimally two members required for the superlative to be applicable.

The comparison set 'presupposition' (X) has in common with traditional presuppositions that there is a requirement to find an antecedent for it. A standard resolution algorithm would try to bind the comparison set presupposition X to some antecedent set, and if this fails, X is accommodated following van der Sandt's Resolution Constraints and Preferences (Definition 9a). These rules include the Informativity and Consistency Constraints. (van der Sandt, 1992). We know at this point that the 'presuppositional' DRS in (85) is not really presuppositional in the traditional sense of the word (thus the ' ' around 'presupposition'). This is because the contexts used in familiar studies (mainly in dynamic semantics, such as van der Sandt, 1992; Kamp et al., 2008) refer mostly to the Discourse Context K_{Dis} in the articulated context framework, while other context components are rarely considered for presupposition resolution. In these earlier works, when presuppositions bind, they are binding with antecedents in contexts that were established from prior utterances. But since it is very unusual for people to declare explicitly the comparison set prior to using the superlative, accommodation becomes the only prescription, according to existing literature, to deal with the comparison set 'presupposition' triggered by a S-NP. This is the wrong approach given that we now have a framework which spells out the common ground in DRT terms.

${C^*}_{Art}$ is a *contextual restrictor* for the S-NP: C denotes the kind of general contextual restriction that is conceptually similar to the one that was used for defining the existential presupposition of the definite determiner, and '*Art*' stands for articulated contexts. Essentially ${C^*}_{Art}$ is a discourse referent for a set that determines a subset of the universe of one of the components of the articulated context. The underlines indicate that $\underline{\underline{{C^*}_{Art}}}$ is anaphoric[9]. There are two layers of underlining. They indicate that two separate operations must be carried out to resolve the 'presuppositions':

[9] I should note that these 'underlines' that I and (Kamp, et al. 2008) have so acquiescently applied onto the articulated context variable and the contextual restrictor are in fact the same kind of meta-

One for <u>Art</u> and one for $\underline{C^*}$. Following DRT conventions, the innermost underline must be resolved first[10]. This first resolution requires <u>Art</u> to find the relevant articulated context component where the representation of the comparison set can be located. Generally speaking, Art $\in \{ K_{Dis}, K_{Gen}, K_{Enc}, K_{Utt}, K_{Env} \}$. Once the context component is defined (<u>Art</u> identified with one of the five components), the second resolution will be to find the relevant subset C of entities which satisfies Q that makes up the comparison set in which the S-NP is a member of.

Finding the most *salient and relevant*[11] context component to resolve a presupposition is an extremely complicated task. Even though it was hinted by Lewis (1979) that certain rules may assist us in keeping track of the salience of entities being talked about (e.g. in the case of definite descriptions, *Rule of Accommodation for Comparative Salience*), it is entirely unclear how far we can take these rules in an open-ended discourse environment. The attention span of the interlocutors and their psychological processes must be weighed in while these factors are far beyond what any linguistic theory can account for. For this reason I will only discuss this problem in general terms while using some examples. Let us suppose that the (comparison) set of mountains in (82a) was never mentioned in prior utterances, and so its antecedent cannot be found in the discourse context. We would be inclined to assume that the articulated context component where this information can be found is the interlocutors' general K_{Gen} or encyclopedic knowledge K_{Enc}. An example where another component

language as those instructions specified in $\mathbb{U}$ and $\mathbb{E}$ in Chapter 3. The 'underline' is *not* a discourse condition.

[10] $\underline{\underline{C^*}_{Art}}$ is really the shorthand for:

$$\left\{ \left\{ \boxed{\begin{array}{c}\underline{\text{Art}}\\ \\ \\ \end{array}} \right\}, \boxed{\begin{array}{c}\underline{C}\\ \\ C^* \subseteq U_{Art}\end{array}} \right\}$$

U_{Art} is the discourse universe of the subsequent articulated context component. For an ordered-pair notation like the above, the left inner-most presuppositional DRS must be resolved first.

[11] I am using the concept of salience and relevance very loosely, along the lines of David Lewis (1979).

is salient: Suppose the interlocutors are standing in front of a landscape consisting of mountains. With the intention to talk about a specific mountain at the scene, one of them utters "the highest mountain…". In this scenario, it seems clear that the most salient context is the environment context, because the (highest) mountain referred to is amongst the mountains within the direct environment of the utterance. The mountains and the height relations between them can be seen as part of K_{Env}. A further complication arises when all of the interlocutors in front of the landscape realize that they are familiar with these mountains: familiar in the sense that they know their names, and perhaps but not necessarily some other attributes such as height, location, etc. These information belong in the interlocutors' encyclopedic knowledge. Therefore, under this circumstance, the very mountains represented in K_{Env} should be anchored to their counterparts in K_{Enc}. These examples are deictic uses of the definite NP 'the highest mountain', where a member in the immediate environment shared by the interlocutors serves as the antecedent for the existence presupposition of the definite. Deictic use of a definite NP is only interpretable after the interlocutors have agreed to have K_{Env} as the most salient context where the comparison set is to be sought. It may appear easy in the case of deictic expressions to select the most salient component of the articulated context, but in general, as a sub-task of interpreting S-NP's, this is not simple at all.

When $\underline{\underline{C_{Art}}}$ is resolved to $\underline{C_{Enc}}$ (or $\underline{C_{Env}}$, or any other context component for that matter), the selected articulated context component lies at the center of the interlocutors' attention, and this component is where they believe the referred entities can be retrieved. The remaining underline indicates that a further restriction on that context component's discourse universe is required before the antecedent for the comparison set can be determined. The reason for this further restriction is that even though we know where in the common ground we are to look for the relevant comparison set, there remains the separate question as to *what exactly that set consists of*. (82a) explicitly states that the comparison set is the set of mountains in the Americas, while (82b) claims it is the set of all mountains from around the world. However, S-NP do not always make their comparison set explicit as in (82). Suppose without any background context, we have:

(86) Speaker: The highest mountain is Aconcagua.

The comparison set intended for the above S-NP can be mountains in the Americas, or just as likely, mountains in Latin America, South America, mountains in the Andes, or mountains in Argentina: Aconcagua turns out to be the highest of all of the aforementioned sets. More such sets of mountains may be construed, if perhaps less obvious without a background context. There is nothing in (86) that tells us where to draw the line, and for this reason, C has to be left *underspecified* with certain constraints. For (86), if it is known by the interlocutors that Mt. Everest is the highest mountain in the world, for example, then there must be a constraint such that C does not include Mt. Everest as a member, nor any of its associates (mountains near Mt. Everest are also conceivably higher than Aconcagua). One could perhaps induce from this that mountains of a certain geographic area e.g. the Himalayas, or Asia, are not considered part of C. But what are the rules governing such reasoning? Instead of pursuing this, I will simply say that any mountain that is higher than Aconcagua must be excluded from C if at all possible, so that (86) comes out true. Still, simple avoidance of inconsistency is not sufficient enough for determining the precise constituents of C.

Another issue that made the contextual restrictor an essential component of the semantics of S-NP is the ambiguity between absolute and comparative readings. This ambiguity was first made prominent by Heim (1985) and Szabolcsi (1986), both of which proposed a syntactic solution that was later refuted in Teodorescu (2009). There has been a lot of debate on whether what we are dealing with are truly distinct readings, what precisely is responsible for these different readings, and how they are computed. Unfortunately, very little consensus has been established, even with what's often called "intuitive readings". One thing is certain however, the cause of these different readings is pragmatic in nature (preconceived context, salience, and information structure). I would like to show here that both readings can be generated using the DRT apparatus I am using, and that the difference in these readings is attributed to the difference in the choice of domain restriction for the S-NP. Consider the following sentences with different focus background articulation:

(87) a. John climbed the highest mountain.

b. John climbed the $[\text{HIGHEST}]_F$ mountain.

c. $[\text{JOHN}]_F$ climbed the highest mountain.

(87a) seems uncontroversial until we consider (87b) and (87c). For (87b), 'highest' bears overt focus accent. According to Szabolcsi (1986, p. 250), it has the absolute reading: John climbed the highest mountain in the world (or rather, as I have been hinting up to this point, the highest mountain in C). I do not quite agree with her intuition, however, the same sentence *without* any focus articulation as in (87a) unequivocally has that meaning. For demonstration, I will assume Szabolcsi's judgement is correct and treat (87b) as having the same meaning as (87a). Given that the highest mountain in the world is Mt. Everest, (87a) (and (87b)) states that John climbed Mt. Everest. (87c) on the other hand, has a different meaning. With the focus placed on John, (87c) means that John climbed a higher mountain than anybody else climbed in some contextually salient domain. Under this reading, (87c) may well be true when John only climbed a small hill in his neighborhood, as long as nobody else in the relevant context climbed any mountain that is higher. It is well-known that the wh-word in interrogative sentences constitutes the focus of that sentence. Gutierrez-Rexach (2005) pointed out that a superlative phrase in an interrogative has the comparative reading when the comparison set is drawn from alternatives in the domain associated with the wh-element, (87c) therefore answers the question "who climbed the highest mountain of all the mountains climbed by anybody?". I will take it for granted here that wh-focus licences the comparative reading of a S-NP. There is nevertheless a *prima facie* case for regarding superlatives as a case of free focus association, because association with focus is not compulsory (Beaver & Clark, 2007). This means for (87c) the highest mountain may well be the highest in an independently salient set of mountains C, for example C could be mountains in the Americas, or the Andes.

The determination of C in S-NP utterances in (87) may first be approached by listing all of the alternatives to the focus marked constituent in a focus background articulation. To do this we must first incorporate an account of focus background articulation into DRT. I will only sketch out the framework here and refer to Kamp (2004) for details. (87b) has the following context representation and focus frame focus division (ff-f division for short):

(88)
$$\underset{\substack{\uparrow \\ \text{Context, } (C)}}{\boxed{\begin{array}{c} \text{a} \quad \text{b} \quad \text{c} \quad \text{j} \quad \text{m} \quad \text{s} \\ d_a \quad d_b \quad d_c \\ \text{John(j)} \quad \text{Mary(m)} \\ \text{Sue(s)} \quad \text{mountain(a)} \\ \text{mountain(b)} \quad \text{mountain(c)} \\ d_a > d_b > d_c \\ \text{climb(j, b)} \\ \text{climb(m, c)} \end{array}}}, \left\langle \left\{ \underset{\substack{\uparrow \\ \text{Presupposition}}}{\boxed{\begin{array}{c} \delta \\ \text{a} \in C_{\mathit{ff}-f} \\ \delta \in C_{\mathit{ff}-f} \\ \delta \neq \text{a} \\ \text{mountain}(\delta) \end{array}}} \right\}, \left\langle \underset{\substack{\uparrow \\ \text{Restrictor}}}{\boxed{\begin{array}{c} \mathbf{x} \\ \mathbf{x} \in C_{\mathit{ff}-f} \end{array}}}, \underset{\substack{\uparrow \\ \text{Focus Frame}}}{\boxed{\text{climb(j, x)}}}, \underset{\substack{\uparrow \\ \text{Focus Constituent}}}{\boxed{\text{x = a}}} \right\rangle \right\rangle$$

A ff-f division and its presupposition is separated from the context of the sentence (C)[12], which is represented on the left end of the representation above. This is because ff-f division deals strictly with focus background articulation, it is a means to represent and derive all the possible alternative semantics attributed to a certain part of a sentence being focus marked. The ff-f division in (88) assumes that presuppositions from other triggers such as proper names (John), the definite determiner 'the', are already resolved and accommodated in the context.

The first component of the ff-f division is the DRS on the center right, the one that contains the condition $\mathbf{x} \in C_{\mathit{ff}-f}$. This component is called a restrictor. A restrictor consists of the focus variable $\mathbf{x}$, displayed in bold, and a restrictor predicate $C_{\mathit{ff}-f}$. $C_{\mathit{ff}-f}$ stands for restrictions on the focus variable, such as quantification, abstraction, and so on, that are not explicit in the sentence itself, but must be inferred from context. To provide a simple example, suppose the interlocutors of (87b) have in their

[12] The context (C) is predetermined for this example. For simplicity it encompasses all relevant information from the union of all five components of the articulated context. Notice how according to this context, John in fact did *not* climb the highest mountain. The expression in (87b) is therefore either *false*, or some form of *accommodation* must take place, such that the information John climbed the highest is recorded in (C).

common ground three mountains under their attention: mountain a, b and c, then C_{ff-f} is restricted to these three individuals. In this case, C_{ff-f} is the property of being a member of the set consisting a, b, and c. The restrictor of a ff-f division represents all possible values of the focus variable under the given context. **x** replaces the focus marked constituent *highest mountain* in the semantic representation of (87b). This replacement of the focus marked constituent by the focus variable produces the separation of focus constituent from focus frame, which are the other two components of the ff-f division. The focus frame is the outcome of semantic construction from the syntactic tree of the sentence, using the bottom-up Box + λ method. The focus constituent of a ff-f division states that the value of the focus variable is that of mountain a. Each ff-f division comes with a presuppositional constraint on its alternative set (Rooth, 1992). This means there must be at least one other element δ in C_{ff-f} besides the focus marked constituent that may serve as its alternative and be identified with the focus variable in the focus constituent. In the case of the above example, mountain b is an alternative to mountain a as a potential candidate for being climbed by John. The presuppositional DRS of the focus is the DRS between the curly brackets located in the center. It states that there has to be at least one other mountain (δ) in context (C) such that it is not mountain a.

I argue here that in order to get comparative readings for a sentence like (87c), its information structure should be analyzed as the more complex type of *Topic-Focus* structure that was made prominent in the work of Büring (1997). Instead of the simple focus-background type in Rooth (1992), (87c) should be analyzed as follows:

(89) [JOHN]$_T$ climbed the [highest]$_F$ mountain.

The above annotations come with two presuppositions: The focus marking indicates the presupposition of alternatives to the focus constituent, it is the equivalent of C_{ff-f} that was described earlier. Let us call this the *focus set* F. The topic marking indicates the presupposition of a similar *topic set* T. T is a set that includes the alternatives to John in (89). I use the notation $[\![.]\!]^0$ to denote semantic values *à* la Rooth (1992). $[\![\alpha]\!]^f$ is the focus semantic value for the phrase α, which is a set of alternative propositions when α is a sentence, a set of alternative entities when α is a noun phrase. $[\![\alpha]\!]^{o}$ is the ordinary semantic value for α. The ordinary semantic value is always a member of the focus semantic value. $[\![\alpha]\!]^{t}$ then, is the topic semantic value of α. According to Büring's original analysis, the topic semantic value of (89), $[\![(89)]\!]^{t}$, is a set of sets- for each member x of the topic set T (John and his alternatives in (C)) there is a focus set F_x assigned to it (the highest mountain, the second highest mountain, etc.), as in the following:

(90) $[\![(89)]\!]^{t}$ = {{John climbed the highest mountain, John climbed the second highest mountain, John climbed the third...}, {Mary climbed the highest mountain, Mary climbed the second...}, {Sue climbed the highest...}, ...}

The preliminary representation for (89) is as follows:

(91)
$$(C), \left\langle \left\{ \left\{ \left\{ \left(\boxed{\begin{array}{c} \underline{\mathrm{T}} \quad \beta \quad \mathrm{e} \\ \\ \mathrm{j} \in \mathrm{T} \\ \beta \in \mathrm{T} \\ \beta \neq \mathrm{j} \\ \mathrm{mountain(e)} \\ \mathrm{climb}(\beta,\ \mathrm{e}) \end{array}} \right) \right\}, \left\langle \boxed{\begin{array}{c} \mathbf{x} \\ \\ \mathbf{x} \in \mathrm{T} \end{array}}, \boxed{\begin{array}{c} \mathrm{f} \\ \\ \mathrm{climb(x,\ f)} \\ \mathrm{mountain(f)} \end{array}}, \boxed{\begin{array}{c} \\ \mathrm{x} = \mathrm{j} \end{array}} \right\rangle \right\}, \right.$$
$$\left. \boxed{\begin{array}{c} \underline{F_x} \quad \delta \\ \\ \mathrm{a} \in F_x \\ \delta \in F_x \\ \delta \neq \mathrm{a} \\ \mathrm{climb}(\mathrm{x},\ \delta) \end{array}} \right\}, \left\langle \boxed{\begin{array}{c} \mathbf{y} \\ \\ \mathbf{y} \in F_x \end{array}}, \boxed{\begin{array}{c} \\ \mathrm{climb(x,\ y)} \end{array}}, \boxed{\begin{array}{c} \\ \mathrm{y} = \mathrm{a} \end{array}} \right\rangle \right\rangle$$

An explanation for (91) is in order, starting from top left: The first DRS is the context (C). Moving to the right of the context we find the first and innermost presupposition. It consists of the topic set T, triggered by the topic marking of (89).

It states that John is a member of T, and that there is at least one alternative to John, β, who climbed some mountain. β is the presupposition of the S-topic. Further to the right is the topic frame topic (tf-t) division. Mirroring the ff-f division, the tf-t division has a restrictor, a topic frame and a topic constituent. The tf-t division states that a person from the topic set T climbed a certain mountain, and that person, as specified in the topic constituent, is John. f in the topic frame is a place holder for the focus variable y that is yet to come. Moving further down to the second row of the Preliminary DRS is the presupposition triggered by the focus marking, and its ff-f division. The nested presuppositional structure here reflects that the presupposition of the focus is dependent on the presupposition of the topic. The focus presupposition states that there is a focus set F_x and the highest mountain **a** is a member of F_x. There is also another mountain δ in F_x such that the topic variable x climbed δ. We may in fact generate all the semantic values that were listed in (90) using the focus frame of this ff-f division, while the topic marked constituent in combination with the focus marked constituent being John and the highest mountain (a) make up the ordinary semantic value of (89).

I argue here that $\mathrm{F} = \cup \{\mathrm{F}_x \mid \mathrm{x} \in \mathrm{T}\}$ is the set of all possible alternatives to the focus constituent, it denotes in (91) the set of all mountains in context which *could have been climbed* by someone. The contextual restrictor C for the S-NP in comparative readings of focus marked sentences is identified to the F of that sentence. F, however, is *not* the set of mountains that are *actually climbed*. What we are ultimately interested in, the comparison set X, is a subset of F: The set of mountains that are *actually climbed* by somebody from the Topic Set T. These mountains constitute the comparison set X, and we can only obtain them by verifying F with the context to determine which of the mountains are indeed climbed by members of T.

So far we have seen how the contextual restrictor and the comparison set are derived in focus marked S-NP sentences. However, most S-NP utterances have no focus articulation and the derivation method we have been using for topic-focus sentences does not apply. Often one must resort to very complex cognitive processes when interpreting S-NP utterances with an underspecified C. Fortunately, C is sometimes made explicit, as in (82), and we return to it at this point. (82a) specifies that the comparison set X consists of mountains in the Americas, whilst C without contextual restriction from a prior discourse or other presupposition triggers, is identified to the comparison set[13]. The result of combining the definite determiner (84) with

[13]Many existing literatures on the superlative do not make the distinction between the comparison set X and the contextual domain C in which the definite determiner is responsible for. Nevertheless, this is distinction is important, because sometimes they may not be identical, even though this is so for (82a). Consider the following example taken from Gutierrez-Rexach (2005):

(i). John went to the mall. He bought his wife the most expensive present.

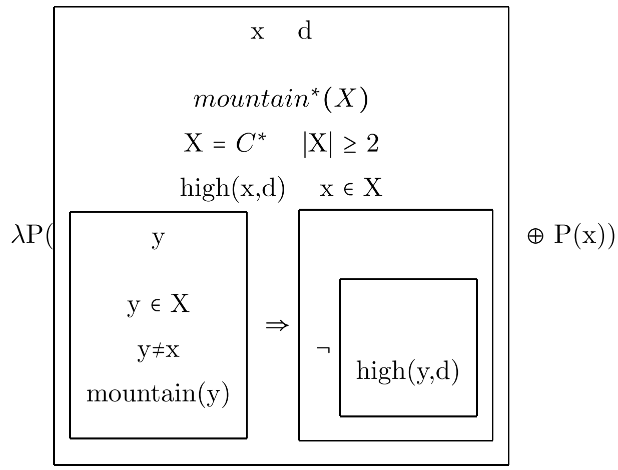
Gutierrez-Rexach argues that due to bridging from the first sentence, all things in the mall constitute members of the contextual restrictor C for the definite in the second sentence, *as well as* serving as the comparison set for the superlative 'most expensive'. I agree with him that it is indeed the definite determiner which triggers the contextual restrictions. However, the restriction of the first definite occurrence is not the same as the second occurrence. Consider a variation of his example:

(ii). John went to the_1 mall. He fell off the_2 escalator. Nevertheless, he managed to buy his wife the_3 most expensive present.

If we assume all three occurrences of the definite are drawn from the same contextual domain, we are left with the question: Suppose the escalator is the most expensive object in the mall, did John buy an escalator for his wife? This is very unlikely. It should be obvious that the escalator meant here belongs in a completely different domain separate from the list of purchasable objects in the mall, even though the *same bridging* applies to 'the_2' just as well as 'the_3'. The lesson from this is that distinctions must be made between the three occurrences of the definite: C_1, C_2, and C_3 probably consist of very different set of objects, e.g. C_1 is a set of underspecified localities in John's neighborhood, C_2 a set of (underspecified) facilities in the mall, and C_3 a set of (underspecified) goods and services sold at the mall.

Some kind of selectional restriction ought to distinguish escalators from the purchasable goods at the mall. It is not within the scope of this chapter to define such selectional restriction. However, a simpler solution would be to assume the comparison set X as a subset of C, X ⊆ C. This gives us the option that while C may be underspecified, we do not have to commit ourselves to the strong claim that every member of C is subject to the comparison imposed by the superlative, but only the superlative entry (85) through Box + λ, is as follows:

(92) 'the highest mountain (in the Americas'), K_{Dis}:



C^* = {z | z is a mountain (or some mountains) in the Americas}

Before we move on to sentences involving ordinals, I would like to raise an example where the contextual restrictor C is *not* identified with the comparison set X (Gawron, 1994):

(93) a. [MARY]$_F$ gave her sister the biggest box.

Interpretation (strict identity): of all x such that x gave Mary's sister boxes, Mary gave Mary's sister the biggest box.
Comparison set: a set of boxes given by somebody to Mary's sister.

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a relevant fraction of it. This approach does not tell us what actually constitutes C_1, C_2, or C_3, a theory external to the theory of superlatives is responsible for that. But X as a subset of C_3 permits the possibility that C_2=C_3, while at the same time barring the escalator from being included in the same set as the things John could possibly buy (that set being X), thus preventing it from becoming the most expensive present John bought for his wife. A more optimal solution should help us pin down the approximate (or even exact) contents of C_1, C_2 and C_3, but that begs for a much more comprehensive theory about contextual restriction and salience than is currently available.

Interpretation (sloppy identity): of all x such that x gave x's sister boxes, Mary gave Mary's sister the biggest box.

Comparison set: a set of boxes given by somebody to that person's sister.

b. Mary gave [HER SISTER]$_F$ the biggest box.

Interpretation: of all x's such that Mary gave x boxes, Mary gave the biggest box to Mary's sister.

Comparison set: a set of boxes given by Mary to somebody.

c. Mary gave her sister the biggest box.

Interpretation: Mary gave the biggest box amongst all the boxes in some salient context to Mary's sister.

Comparison Set: a set of boxes in some salient context.

Taking the earlier approach thanks to Büring, and assuming that it is already held in the common ground that Mary's sister is Sue, we will analyze (93a) as (94a) and (93b) as (94b):

(94) a. [MARY]$_T$ gave Sue the [biggest box]$_F$.

b. Mary gave [SUE]$_T$ the [biggest box]$_F$.

Similar to (89), the above annotations come with two presuppositions: The focus set F and the topic set T. T is a set that includes the alternatives to Mary in (94a), and Sue in (94b). Let $[\![\alpha]\!]^f$ be the focus semantic value for the NP α in (94), a set of alternative entities. $[\![\alpha]\!]^0$ is the ordinary semantic value for α. The ordinary semantic value is always a member of the focus semantic value. $[\![\alpha]\!]^t$ then, is the topic semantic value of α. Using Büring's analysis, the topic semantic value of (94a), $[\![(94a)]\!]^t$, is a set of sets- for each member x of the topic set T (Mary and her alternatives) there is a focus set F$_x$ assigned to it (the biggest box, the second biggest box, etc.), as in the following:

(95) $[\![(9'\text{a})]\!]^t$ = {{Mary gave Sue the biggest box, Mary gave Sue the second biggest box, Mary gave Sue the third...}, {John gave Sue the biggest box, John gave Sue the second...}, {Sue gave Sue the biggest box,...}, ...}

The Preliminary DRS representation for (94a) is as follows[14]:

$$\begin{array}{|c|}\hline \text{a} \quad \text{b} \quad \text{j} \quad \text{m} \quad \text{s} \\ \text{box(a)} \quad \text{box(b)} \\ \text{biggest(a)} \\ \text{John(j)} \quad \text{Mary(m)} \\ \text{Sue(s)} \\ \hline \end{array}, \left\langle \left\{ \left\{ \left\{ \begin{array}{|c|}\hline \underline{\text{T}} \quad \delta \quad \text{c} \\ \text{m} \in \text{T} \\ \delta \in \text{T} \\ \delta \neq \text{m} \\ \text{box(c)} \\ \text{e: gave}(\delta, \text{c, s}) \\ \hline \end{array} \right\}, \boxed{\left\langle \begin{array}{|c|}\hline \text{x} \\ \text{x} \in \text{T} \\ \text{person(x)} \\ \hline \end{array}, \begin{array}{|c|}\hline \text{e} \quad \eta \\ \text{e: gave(x, } \eta\text{, s)} \\ \hline \end{array}, \begin{array}{|c|}\hline \text{x = m} \\ \hline \end{array} \right\rangle} \right\},\right.$$

$$\left. \begin{array}{|c|}\hline \underline{\text{F}_x} \quad \zeta \\ \text{a} \in \text{F}_x \\ \zeta \in \text{F}_x \\ \zeta \neq \text{a} \\ \text{e:gave(x, } \zeta\text{, s)} \\ \hline \end{array} \right\}, \boxed{\left\langle \begin{array}{|c|}\hline \text{y} \\ \text{y} \in \text{F}_x \\ \text{box(y)} \\ \hline \end{array}, \begin{array}{|c|}\hline \text{e} \\ \text{e: gave(x, y, s)} \\ \hline \end{array}, \begin{array}{|c|}\hline \text{y = a} \\ \hline \end{array} \right\rangle} \right\rangle$$

Starting from top left, the first DRS is the context. Once again, for illustration, I assume the proper names (Mary, etc.) and the definite ('the biggest box') have already been dealt with and anchored. I also throw in another (pre-established) box **b** into the context, since **a** cannot be the 'biggest' unless there is another box that is smaller than **a** (presumably **b** was mentioned already or was in sight of the interlocutors). Moving to the right of the context is the first and innermost presupposition. It consists of the topic set T, triggered by the topic marking of (94a). It states that Mary is a member of T, and that there is at least one alternative to Mary, δ, who gave out some box to Sue. δ is the presupposition of the S-topic[15]. Further right is the topic frame

[14]The predicate 'biggest' here is an abbreviation of the superlative defined in (85). All of the presuppositions in (85) are assumed to have been resolved in the context DRS. If one is unwilling to make such an assumption, one may simply stack the DRS structures in (85) as presuppositions to the left of the presuppositional DRSs of (94a).

[15]The presupposition triggering sentence can be used to answer certain questions either contrastively or partially, as stated in Büring (1995):

(i) Q: Which box did John give to Sue?
A: $[\text{Mary}]_T$ gave Sue the $[\text{biggest}]_F$ box. (Contrastive topic)

(ii) Q: Which box(es) did the girl scouts give to Sue?
A: $[\text{Mary}]_T$ gave Sue the $[\text{biggest}]_F$ box. (Partial topic)

topic (tf-t) division. Mirroring the ff-f division, the tf-t division has a restrictor, a topic frame and a topic constituent. The tf-t division states that a person from the topic set T gave something to Sue, and that person, as specified in the topic constituent, is Mary. η in the topic frame is a place holder for the focus variable y that is yet to come. Moving further down to the second row of the Preliminary DRS is the presupposition triggered by the focus marking, and its ff-f division. The nested presuppositional structure here reflects that the presupposition of the focus is dependent on the presupposition of the topic. The focus presupposition states that there is a focus set F_x and the biggest box **a** is a member of F_x. There is also another box ζ in F_x such that the topic variable x gave ζ to Sue. We may in fact generate all the semantic values that were listed in (95) using the focus frame of this ff-f division, while the focus marked constituent in combination with the topic marked constituent being the biggest box and Mary make up the ordinary semantic value of (94a).

The specific type of examples raised in (93) allow us to *flatten* the structure of $[\![(94a)]\!]^t$ by virtue of the fact that when a box is said to be given by someone, the possibility of the same box being given out by another person is automatically excluded. For this reason we may justifiably place a constraint on each member of the focus set F so that they are assigned to a member of T *only once*. This allows us to safely assume $F = \cup \{F_x \mid x \in T\}$. Recall that F is the set of all possible alternatives to the focus constituent. In (94a), F denotes the set of boxes in context which *could have been given*, or potentially given, by someone to Sue. I argue that the contextual restrictor C for the S-NP in comparative readings of focus marked sentences is identified to the focus set F of that sentence. F, however, is *not* the set of boxes that are *actually given* to Sue. What we are ultimately interested in, the comparison set X, is a subset of F. The set of boxes that are actually given to Sue in the context of the utterance is compared to each other with regard to their size so that the biggest one can be determined. This set of given boxes is the comparison set X.

The reason for C to be the set of potentially given boxes instead of actual given boxes is because there are instances where a definite noun shares the same contextual restrictor C as the S-NP and refers to a box that is not given to Sue, e.g. "MARY gave Sue the biggest box, but she did not get *the blue one*". 'The blue one' refers to a blue box which nobody gave to Sue, but nevertheless could have been given to her (in an alternative world, for example). An argument is made here that the two definites in that sentence presupposes two different contextual restrictors. However, the second contextual restrictor (triggered by 'the blue one') would have required the hearer to accommodate, and this is not the preferred option when he could simply identify the second contextual restrictor with the first. There is nothing in this example that prevents such identification or makes the shift of contextual restrictor mandatory.

4.6 Ordinals and Ordinals Superlatives

OS-NP have in common with S-NP some key features such as the comparison set, ordered by a comparison dimension[16]. The departure between the two begins as semantic representations of OS-NP's which require a formal DRS account of what's involved in counting, i.e. of the natural numbers and of *Well Ordering*. Fortunately, a set of axioms for the natural numbers was presented by the 19th century Italian mathematician Giuseppe Peano, and if necessary they can be readily converted into

[16]It was mentioned in the Superlative section that the difference between O-NP and OS-NP is only significant during presupposition resolution (the semantic-pragmatic interface). The reason for this is because in O-NP, the comparison dimension is unspecified and must be recovered from context, whereas in OS-NP, the dimension is provided by the superlative adjective. There is a further question that arises from this discrepancy however: If we strictly follow the principle of compositionally, and if an O-NP is to assert the existence and uniqueness of 'the n_{th} NP', then there is a conflict in an OS-NP. If we look at (82b), on the one hand, the S-NP in the OS-NP will follow (85) and refer to the highest mountain and assert its existence and uniqueness, on the other hand the ordinal in the same OS-NP will point to the 26_{th} and assert *its* existence and uniqueness instead. Why is it that the 26_{th} highest mountain becomes the asserted one and not the highest mountain? In other words why does the ordinal in an OS-NP tend to suppress the meaning of the S-NP that constitutes its part? To this I do not have an answer.

DRT terms. First we define *Well Ordering*:

A set X is Well Ordereded ($\mathcal{WE}$) by < iff

1. X is linearly ordered by <

2. $(\forall Y \subseteq X)(Y \neq \varnothing \rightarrow (\exists y \in Y)(\forall z \in Y)(y < z))$, Every non-empty subset Y of X has a <-first (least) element.

Peano Axioms ($\mathcal{P}$) for natural numbers are as follows, where S denotes the successor function:

1. $\neg\exists x(S(x) = 0)$
2. $\forall x\exists y(x \neq 0 \rightarrow S(y) = x))$
3. $\forall x\forall y(S(x) = S(y) \rightarrow x = y)$
4. $\forall x(x + 0 = x)$
5. $\forall x\forall y(x + S(y) = S(x + y))$
6. $\forall x(x * 0 = 0)$
7. $\forall x\forall y(x * S(y) = x * y + x)$

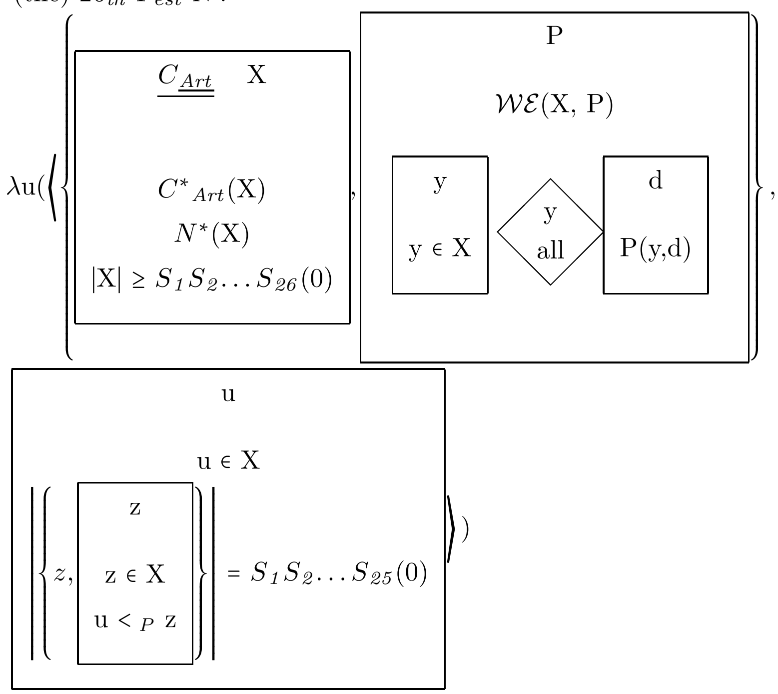
The Induction Scheme ($\mathcal{IS}$) states that if a property is possessed by 0 and also by the successor of every natural number which possesses it, then it is possessed by all natural numbers:

$\forall v_1 \ldots v_n((F[0, v_1, \ldots, v_n] \wedge \forall v_0(F[v_0, v_1, \ldots, v_n] \rightarrow F[Sv_0, v_1, \ldots, v_n])) \rightarrow \forall v_0 F[v_0, v_1, \ldots, v_n])$, Where n is an integer, and $F[v_0, v_1, \ldots, v_n]$ is any formula whose only free variables are $v_0, v_1, \ldots, v_n$.

We may incorporate these key definitions and Axioms into our DRT formalism: '0' is the only new discourse referent that needs to be introduced, and it is always anchored to the the number zero. We assume that our models contain the natural numbers as part of their domain of individuals and thus the constants '0', 'S', '+' and '$*$' will always have interpretations that are consistent with Axioms 1-7.

The semantic representation for the OS-NP '(the) 26_{th} P_{est} N' where P is the degree adjective and N is a singular noun, is in (96) below. Note that its contextual restrictor, like its S-NP counterpart, is related to the definite determiner which adjoins the ordinal number:

(96) '(the) 26_{th} P_{est} N':



The first presupposition, like S-NP, contains the contextual restrictor C which must first be resolved to an articulated context component, then to a certain subset of the universe of that component depending on the descriptive content of the noun, focus articulation, and any relevant factors from the common ground. The representation of this presupposition uses the successor function S, it states that the comparison set of '26_{th}' must consist of at least 26 members, for otherwise the utterance would be infelicitous. The second presupposition states that the comparison set X is *Well Ordered* with respect to P. P is a relation between members of X and a certain degree d that they possess (in the same sense in which we have been using the term 'degree' so far, d should be a natural number that can be represented using the successor function). P is the comparison dimension, it is the predicate obtained from adjectives such as 'high(er/est)', 'big(er/est)', etc. The comparison dimension is always specified in the superlative for OS-NP's ('the 26_{th} *highest* mountain'), and it is obtained from context for O-NP's (as in (83c)). The second presupposition states that every member of the comparison set must have a P degree, such that X is Well Ordered by P. Finally, the assertional part of (96) states that there are exactly 25 members from within the comparison set besides the asserted OS-NP u that are *higher* than u: a $<_P$ b is defined as follows:

$$a <_P b \text{ iff } (\forall d\ P(a, d) \rightarrow P(b, d)) \wedge (\exists d'\ P(b, d') \wedge \neg P(a, d'))$$

It is easy to see that if the set of degrees is linearly ordered, and P is downward monotone in its second argument, then $\leq_P$ is a pre-ordering, and $<_P$ is asymmetric and transitive. So if a $<_P$ b, it is entailed by downward monotonicity of degrees that b has a unique degree that a does not have. For 'the 26_{th} P_{est} N', there should be exactly 25 N in X, all of which have some P degree d such that u does not have d. When we consider (82b), it follows that there are exactly 25 mountains in the world which are higher than Aconcagua (because they possess degrees of height that Aconcagua does not possess).

Since there are infinitely many integers and there is at least one ordinal number expression for each of them, the entries for the individual ordinals will have to be specified as instances of a general schema. The semantic representation for the O-NP 'the n_{th} N' is as follows. The comparison dimension P must be retrieved from context as it is unspecified in the O-NP:

(97) '(the) n_{th} N':

$$\lambda u(\left\langle \left\{ \boxed{\begin{array}{c} \underline{\underline{C_{Art}}} \quad X \\ \\ C^*{}_{Art}(X) \\ N^*(X) \\ |X| \geq S_1 S_2 \ldots S_n(0) \end{array}}, \boxed{\begin{array}{c} P \\ \mathcal{WE}(X, P) \\ \boxed{\begin{array}{c} y \\ y \in X \end{array}} \left\langle \begin{array}{c} y \\ \text{all} \end{array} \right\rangle \boxed{\begin{array}{c} d \\ P(y,d) \end{array}} \end{array}} \right\} \right.,$$

$$\boxed{\begin{array}{c} \mathrm{u} \\ \\ \mathrm{u} \in \mathrm{X} \\ \left|\left\{ z, \boxed{\begin{array}{c} \mathrm{z} \\ \\ \mathrm{z} \in \mathrm{X} \\ \mathrm{u} <_{P} \mathrm{z} \end{array}} \right\}\right| = S_1 S_2 \ldots S_{n-1}(0) \end{array}} \Big\rangle)$$

4.7 Plural Superlatives and Plural Ordinals

Contrary to what was assumed for singular superlative (SS-NP) and ordinal expressions (SO-NP), the comparison set for PS-NP with or without ordinals are not necessarily linearly ordered: It is possible for two members, a and b, of the comparison set to have the same degrees and be ranked as such: $a \equiv_P b$[17]. In addition, a PS-NP/POS-NP may refer to multiple members of the comparison set across adjacent degrees of the comparison dimension:

(98) a. Mary climbed the highest *mountains* in the Americas.

b. John climbed the second highest *mountains* in the Americas.

In (98), an unspecified number of mountains with similar (but distinct) heights are considered together as occupying the same rank. In other words, there is an ambiguity with regard to the degrees of height that are being referred to with the same PS-NP/POS-NP, since one may refer to the set {Mt. Everest, K2} as 'the highest mountains', just as well as the set {Mt. Everest, K2, Kangchenjunga}, and so on. I will not go into exactly how far we may inflate this set before 'highest' loses its conventional meaning, but it is clear that the PS-NP and POS-NP do not necessarily employ the relation $<_P$ in the way that SS-NP's do. PS-NP presupposes a comparison set with an 'ordered' or 'layered' partition with a top tier that is the denotation of the highest mountains, a tier immediately below the first tier which can be described

[17] $a \equiv_P b$ iff $a \leq_P b \wedge b \leq_P a$

as 'the second highest mountain(s)', and so on[18]. This calls for revision of our earlier analysis of the superlative and the ordinal.

Treatment of the semantics of singular and plural descriptions can generally be unified (Link, 1983). Definite descriptions, as we have been dealing with them so far, are decomposed into two components. One that is due to the definite article 'the' which is neutral between singular and plural; and there is a further contribution from the singular or plural morphology of the noun. When the definite article is applied to a set denoting expression, it carries the presupposition that there is a set of individuals which satisfies the descriptive content of that expression. Singular and plural morphology are therefore presuppositional. As we have already seen, a singular definite imposes the existence and uniqueness presupposition. A plural definite on the other hand signals that its referent is a set that consists of at least two elements[19]. The semantic representation of the plural definite description is obtained this way and is given in (99):

$$\text{(99)} \quad \text{`the': } \lambda P'^{*}\ \lambda P\ \left(\left\langle \left\{ \left\langle \left\{ \boxed{\begin{array}{ll} \underline{C^{*}} & \eta \\ \\ \multicolumn{2}{c}{P'^{*}(\eta)} \\ \multicolumn{2}{c}{C^{*}(\eta)} \end{array}} \right\}, \boxed{\begin{array}{c} \eta = \Sigma \boxed{\begin{array}{c} x \\ \\ P'^{*}(x) \\ C^{*}(x) \end{array}} \\ \\ |\eta| \geq 2 \end{array}} \right\rangle \right\}, \boxed{} \right\rangle \oplus P(u) \right)$$

Σ is the DRT summation sign (Kamp & Reyle, 1993), it states that the discourse referent η is a mereological set consisting of all referents in C that satisfies P'^{*}, whereas P'^{*} is filled in by the descriptive content from the adjoining noun. Moving

[18] The entries for singular and plural definites can be decomposed into a number neutral semantic for 'the'- its denotation is the maximum set of N's that are in C- and the contribution of singular and plural. Singular carries the presupposition that this denotation has cardinality 1. Plural morphology has cardinality > 1.

[19] Furthermore, this set is uniquely restricted by C within the appropriate articulated context component. For the sake of simplicity, this is not represented in (99).

back to superlatives, the Preliminary DRS for (98a) as a result of combining all the lexical entries involved:

(100) $$\left\langle\left\{\left\langle\left\{\boxed{\begin{array}{c}\underline{C^*}\quad \eta\\ ((85)')@mountain^*(u))@(\eta)\\ C^*(\eta)\end{array}}\right\},\ \boxed{\begin{array}{c} \eta = \Sigma\ \boxed{\begin{array}{c}\mathrm{x}\\ ((85)'@mountain^*(u))@(\mathrm{x})\\ C^*(\mathrm{x})\end{array}}\\ |\eta| \geq 2\end{array}}\right\rangle\right\},\ \boxed{\begin{array}{c}\mathrm{m}\\ \mathrm{Mary(m)}\\ \mathrm{climbed}(\mathrm{m},\ u)\end{array}}\right\rangle$$

(85)′ in the above Preliminary DRS refers to the lexical entry of the superlative defined in (85), with a small modification so that u is a discourse referent that can represent either an individual or a set of individuals, and subsequently the $\in$ relation for u is replaced by $\subseteq$ for u:

(85)′ ‘(the) highest’:

$$\lambda Q\ \lambda u(\left\langle\left\{(\boxed{\begin{array}{c}\underline{C_{Art}}\quad \mathrm{X}\\ \\ C^*{}_{Art}(\mathrm{X})\\ |\mathrm{X}| \geq 2\end{array}} \oplus Q^*(X))\right\},\ \boxed{\begin{array}{c}\mathrm{d}\\ \\ \mathrm{high}(u,\mathrm{d})\\ u \subseteq \mathrm{X}\\ (\boxed{\begin{array}{c}\mathrm{y}\\ \mathrm{y} \in \mathrm{X}\\ \mathrm{y} \notin u\end{array}} \oplus \mathrm{Q(y)}) \Rightarrow \boxed{\neg\ \boxed{\mathrm{high(y,d)}}}\end{array}}\right\rangle \oplus \mathrm{Q(u)})$$

(100) can be simplified first by applying the predicate ‘mountain(u)’ to (85)′, and then applying η to the result, instantiating the variable u. This gives us the semantics for ‘the *mountains* in the Americas’ (I assume here as I did before that ‘in the Americas’ specifies the comparison set and consequently the contextual restrictor, therefore, $\underline{C_{Art}}$ is resolved the same way as it was in (92)). Finally, ‘climbed’ and ‘Mary’ enter the assertional part of the Preliminary DRS.

What is interesting about (100) is that given (85)′, the set of highest mountains referred to collectively become a member of the comparison set partition, whilst these mountains must all possess a degree **d** in common, such that no other mountains in the comparison set have **d**. **d** is taken as the minimal degree of height to qualify a mountain in the comparison set as in the league of ‘the highest’- we may regard **d** as a *cut-off line* that distinguishes the highest mountains from the second highest and the rest of the mountains.

Things are not quite as simple for OS-NP. The ways in which we use OS-NP to refer to entities is very complex, especially since POS-NP's have unique presupposition triggers that SOS-NP do not. Let M be a context[20], and d_n some degree. There are in M a set of mountains $\{m_1, m_2, m_3, m_4\}$, each and every mountain possesses one or more of the degrees d_1, d_2, d_3, where $d_1 > d_2 > d_3$:

	M_1	M_2	M_3
d_1	m_1, m_2	m_1	m_1
d_2	m_3	m_2, m_3	m_2
d_3	m_4	m_4	m_3, m_4

Figure 2

Below is a list of all possible POS-NP and the sets of mountains they may refer to in each of the M_1, M_2, and M_3:

	M_1	M_2	M_3
'The highest mountains'	$\{m_1, m_2\}$, $\{m_1, m_2, m_3\}$, $\{m_1, m_2, m_3, m_4\}$	$\{m_1, m_2, m_3\}$, $\{m_1, m_2, m_3, m_4\}$	$\{m_1, m_2\}$, $\{m_1, m_2, m_3, m_4\}$
'The second highest mountains'	$\{m_3, m_4\}$,	$\{m_2, m_3\}$, $\{m_2, m_3, m_4\}$	$\{m_2, m_3, m_4\}$, $\{m_3, m_4\}$
'The third highest mountains'	$\{\varnothing\}$	$\{\varnothing\}$	$\{m_3, m_4\}$

Figure 3

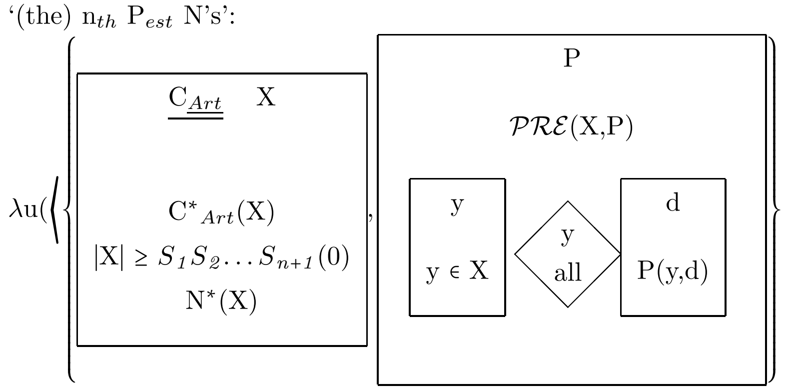
[20] M denotes a specific context, similar to that of the contextual restrictor C. To make things easier to conceptualize, one may think of M as a Model, while bearing in mind that a Context is really a *set* of Models, all of which are consistent with the contents and restrictions defined the Context.

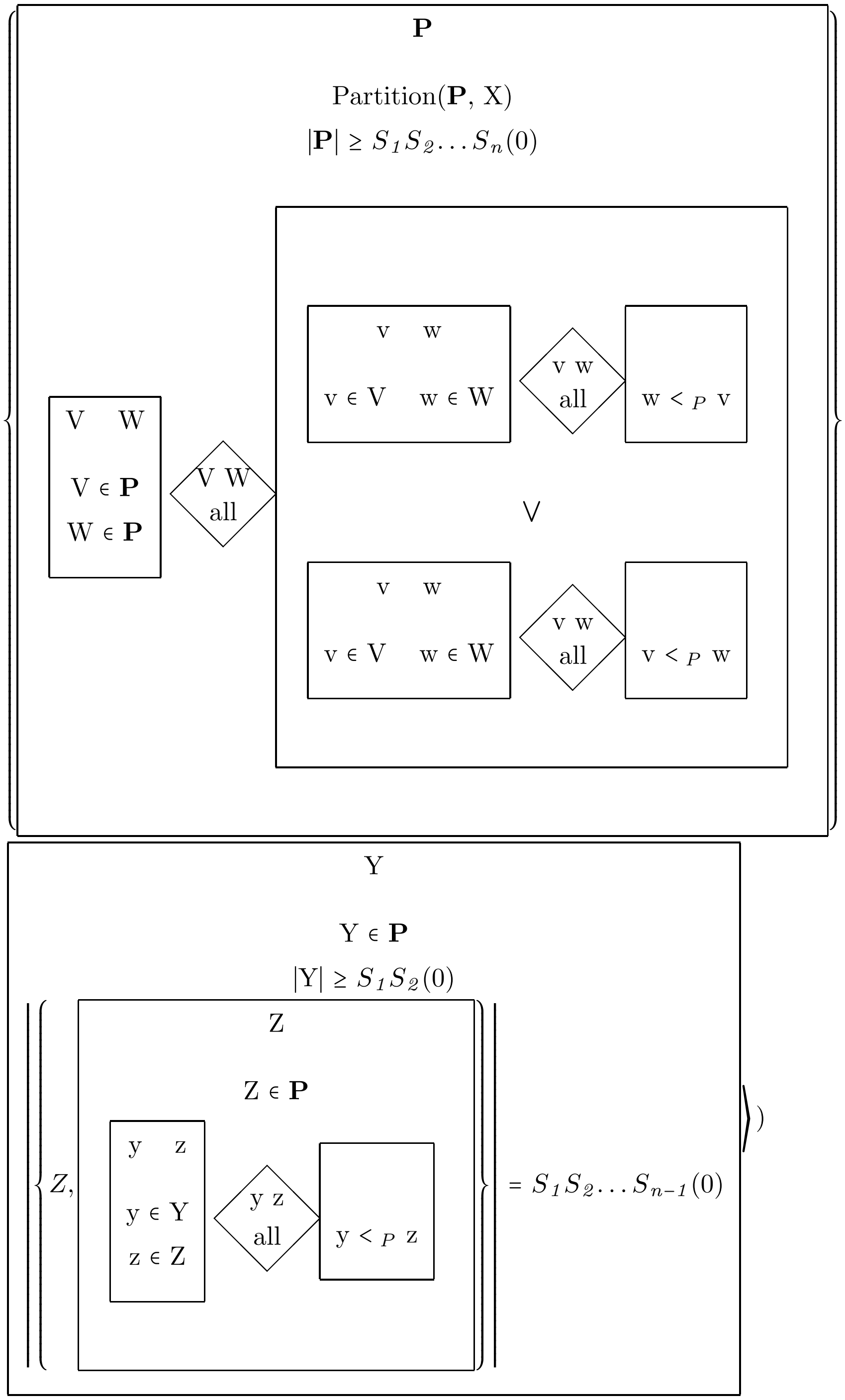
Several important constraints observed from the above jointly determine the set of mountains that a given POS-NP can be used to refer to: First, a POS-NP must refer to at least two mountains. For this reason it is necessary when uttering 'the highest mountain**s**' in contexts such as M_2 or M_3 that mountains besides m_1 must be included, even though m_1 is strictly speaking the tallest, i.e. m_1 has a degree of height that none of the other mountains has. However, not all members in the comparison set of a POS-NP need to follow this constraint, as it only applies to the *asserted* POS-NP. This means when referring to m_2 and m_3 under M_2 as 'the second highest mountains', m_1 remains 'the highest', and m_4 the 'third highest'. The second constraint on a POS-NP is that it may not refer to one member of a degree while excluding another under the same degree. For example, 'the second highest mountains' may not refer to the set $\{m_2, m_3\}$ in M_3 precisely because it separates m_3 from m_4, which is comparable since they are high to the same degrees. Finally, a POS-NP is 'inclusive' in the sense that 'the n_{th} mountains' can refer to all the mountains in d_n *and below* (i.e. d_{n+1}, d_{n+2}, and so on). For instance, in all models, it is felicitous (although a little bit pointless) to refer to all mountains as 'the highest mountains', and in M_2 and M_3, for m_4 to be one of the three 'second highest mountains' (the other being necessarily m_2 and m_3).

Due to the 'inclusive' nature of POS-NP's, the choice of the members for the set classified as 'the n_{th} highest mountains' makes certain presuppositions about other members of the comparison set, other SOS-NP and POS-NP appearing later in the same discourse must conform to that presupposition. To give an example, if we refer to m_3 and m_4 in M_3 as 'the second highest mountains', we presuppose that m_1 and m_2 are considered together as 'the highest mountains', any other configuration would be infelicitous. Another example, in M_1, when one utters 'the highest mountains' with the intention to refer to m_1, m_2, *and* m_3, then it is necessary that m_4 be referred at a latter discourse as 'the second highest mountain'. From this we may conclude that POS-NP do not refer to entities classified by the different degrees of their comparison dimension, but entities classified by *clusters* of degrees. A cluster of degrees is a group of degrees that are adjacent to one another, e.g. in M_1 and M_3, d_1 and d_2 can make a cluster, but not d_1 and d_3. The number of different degrees to be included in a cluster can be arbitrary and underspecified, but the choice of degrees to be included under the same cluster always triggers a presupposition about how the other degrees outside of that cluster ought to be grouped. Because of this added presupposition dimension, POS-NP's require an analysis of their own.

A POS-NP imposes a *partition* on the comparison set X. A partition is a division of X into non-overlapping and non-empty 'parts' (which is synonymous to sets) such that the union of all the parts is X. Each part consists of members of X under a cluster of adjacent degrees. An expression of the form 'the n_{th} P_{est} N's' presupposes at least n many parts, and by virtue of its plural morphology, the n_{th} part has to be a set of *at least two* members, all of which satisfy the descriptive content of N (This entails that X must have at least n+1 members). The parts are ordered by the comparison dimension P. For every pair of parts V and W, either all members of the part W are $<_P$ than those of the part V, or vice versa. So for example all of 'the second highest mountains' are higher than all of the 'the third highest mountains', and 'the third highest mountains' are higher than 'the fourth highest', and so on. A DRS representation for the POS-NP 'the n_{th} P_{est} N's' is as follows:

(101) '(the) n_{th} P_{est} N's':

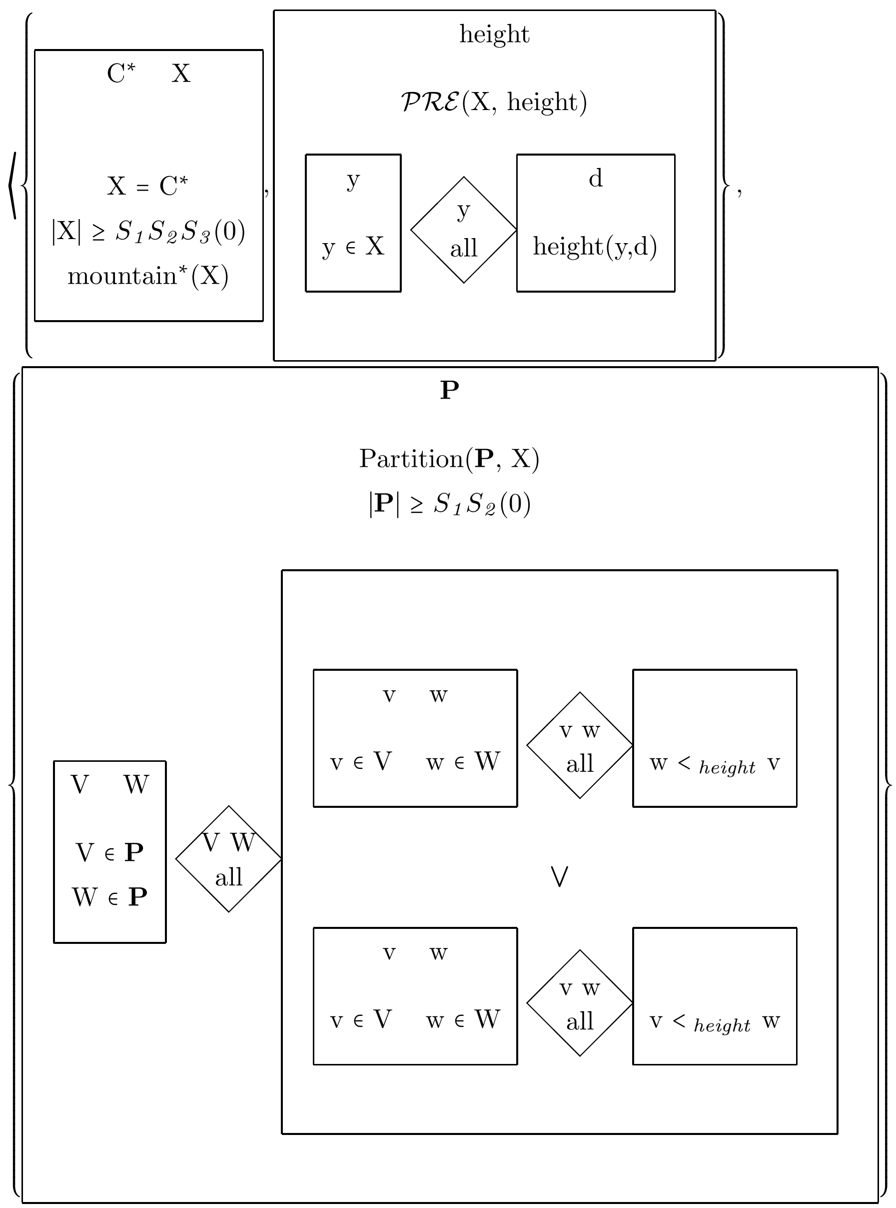


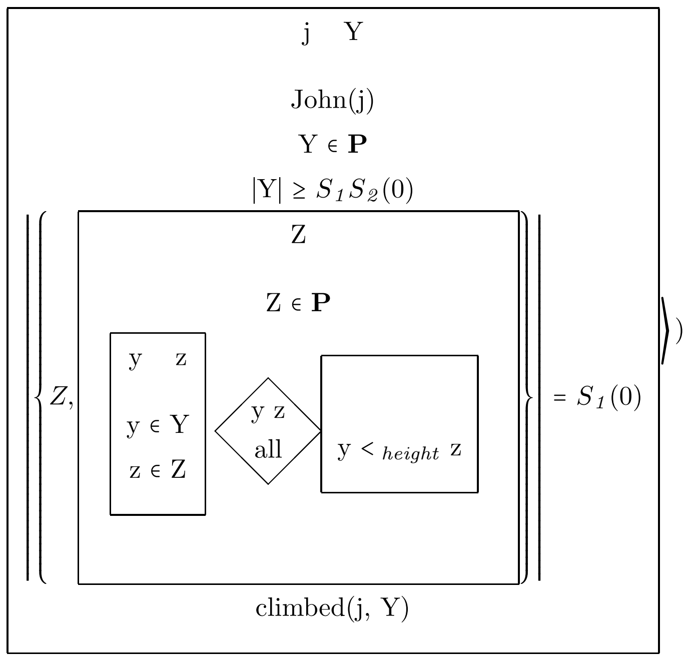


The first presupposition of (101) is similar to the SO-NP in (97) with a slight modification to the Well Ordering of X ($\mathcal{WE}$) earlier: the comparison set X is Pre-ordered by the comparison dimension P. Pre-orders are ordering relations which allows for ties. The added presupposition in the mid-section of (101) introduces the partition.

X is partitioned into n many sets. The partition **P** is the collection of those sets. **P** is a layered partition of X with respect to $<_P$ in the following sense: if V, W are disjoint members of P, either: 1. for all v ∈ V, w ∈ W, v $<_P$ w or 2. for all v ∈ V, w ∈ W, w $<_P$ v. To repeat, if **P** is the partition presupposed by 'the n_{th} P_{est} N's', then **P** has at least n members, and its n_{th} member Y (in terms of the comparison dimension relation between members of **P**) will have to have a cardinality ≥ 2. The other members of the partition, however, can be singletons. The following is a Preliminary DRS for (98b):

(102)





C^* = {z | z is a mountain (or some mountains) in the Americas}

The first presupposition in (102) states that there are at least three mountains in the context where (98b) is uttered, and that this context is said to be the set of all mountains in the Americas. The second presupposition simply pre-orders the comparison set of the ordinal according to the comparison dimension ‘height’. The third presupposition in the middle row says that **P** has at least two members, V and W, where all members of V are higher than those members of W. Finally, the assertional part of the Preliminary DRS states that there is exactly one part Z whose members are higher than those of the asserted, second highest set of mountains Y. During presupposition resolution, Y is identified to W and Z to V. As (98b) states, John climbed the set of mountain Y, it is a set of at least two mountains, all of which are lower than another set of mountains Z (the highest mountains), in the comparison set known as the mountains in the Americas.

A unified treatment can be given to plural superlatives, PS-NP, using the POS-NP entry (101) as template. This strategy would spare the definite determiner from being modified as was in (99). The only difference is that for PS-NP, there must be at least two members in the comparison set (as opposed to n+1, the minimum being three, for POS-NP), and only two parts under the partition **P** are necessary: The highest set of mountains, and the rest of the mountains in the comparison set bunched up in the other set. Once we have seen that the representations for POS-NP's and PS-NP's can be constructed uniformly, the question arise as whether we should retroactively apply a similar approach to SOS-NP's and SS-NP's, making use of the ordered partition presupposition as well? After all, representations for the SS-NP and SOS-NP can be constructed by restricting the cardinality of each part of the partition **P** in the PS-NP/POS-NP representation to one. A natural penchant for more uniformed (and simpler) accounts would certainly suggest we should, but interestingly the answer is less straightforward than might have been thought. There is a strong tendency to assume upon hearing a SS-NP in a discourse initial sentence a linear order of the comparison set X, as we assumed in our earlier treatment of (82a) in (85) (same can be said about (83c)). Of course, this assumption can be easily overwritten as in (103):

(103) John climbed the second highest mountain in the Americas. The two highest *mountains*, however, were climbed by Mary.

In our judgement, a discourse like (103) is all right, although some hearer may get a slight jolt upon hearing the second sentence. In this respect (103) is different from (104), which begins with the SS-NP 'the highest mountain':

(104) John climbed the highest mountain in the Americas. The two second highest *mountains*, however, were climbed by Mary.

In the light of these observations, perhaps the most realistic proposal is that the ordinal partition presupposition is always triggered by all the SS-NP, SOS-NP, PS-NP and POS-NP's. However, certain occurrences of SS-NP's (and SOS-NP's) can give rise to the further implicature that all members of the partition **P** are singletons (and it follows that in these cases X is well ordered). For these reasons, I leave intact the representations of the SS-NP in (85) and SOS-NP in (97) without further ado.

We close this section by putting the POS-NP schema (101) through tests to see if it indeed delivers its promise to represent POS-NP expressions correctly while ensuring its presupposition constraints are maintained throughout the same discourse. Suppose we are given the following discourse involving a PS-NP and a POS-NP:

(105) John climbed the **highest mountains**$_Z$ in the Americas. The **second highest mountains**$_Y$, however, were climbed by Mary.

Let there be four mountains in the common ground: $\{m_1, m_2, m_3, m_4\}$. There are many ways in which (105) can be interpreted. Suppose we take the contexts in Figure 3 as the only ones available for interpretation, the following are snapshots of the highest and the second highest mountains instantiated under each context as the sentences in (105) are processed:

	M_1	M_2	M_3
Z	$\{m_1, m_2\}$, $\{m_1, m_2, m_3\}$, $\{m_1, m_2, m_3, m_4\}$	$\{m_1, m_2, m_3\}$, $\{m_1, m_2, m_3, m_4\}$	$\{m_1, m_2\}$, $\{m_1, m_2, m_3, m_4\}$

Figure 4, Assignment for the first sentence alone

	M_1	M_2	M_3
Z	$\{m_1, m_2\}$	N/A	$\{m_1, m_2\}$
Y	$\{m_3, m_4\}$	N/A	$\{m_3, m_4\}$

Figure 5, Assignment for both first and second sentences

Figure 4 is a snapshot taken after the first sentence of (105) has been interpreted, but before the second sentence enters the picture. As we can see, there are many ways in which ‘the highest mountains’ can be assigned for each of the given contexts at this stage. Figure 5 is a list of compatible assignments for both ‘the highest mountains’ and ‘the second highest mountains’, which is necessary for the interpretation of (105) as a whole. Notice how as soon as the second sentence is processed, the list of potential assignments for ‘the highest mountains’ (from Figure 4) diminishes. This is because the assignments for ‘the second highest mountains’ and those given to ‘the highest’ must be consistent with each other, as the PS-NP and the POS-NP share the same comparison set. The way in which the comparison set is partitioned, according to (101), must be applicable to the PS-NP and all the POS-NP’s occurring in the same discourse. For this reason, there is only one assignment available for M_1 and M_3, and none for M_2, as shown in Figure 5.

If we look at M_1 for example, it is impossible to assign $\{m_1, m_2, m_3\}$ and $\{m_1, m_2, m_3, m_4\}$ to ‘the highest mountains’ for (105) as a whole. Because as soon as we attempt to construct for ‘the second highest mountains’, according to (101), we need at least two mountains available to be assigned to the second highest partition. But if we already assigned $\{m_1, m_2, m_3\}$ to ‘the highest’ partition, then there is only one (m_4) remaining for this task; if we assigned $\{m_1, m_2, m_3, m_4\}$ to ‘the highest’, there will be none left for the second highest. No assignment is available for M_2, because in order to partition the comparison set into two non-atomic parts, we would have to place m_2 and m_3 in two different partitions, but they have the same degree and to do so violates (101) (that for all v ∊ V and all w ∊ W, v < w or w > v. In M_2, $m_2 \nless m_3$ and $m_3 \ngtr m_2$). M_3 is similar to M_1 in that if we assign $\{m_1, m_2, m_3, m_4\}$ to ‘the highest mountains’, we again run into trouble trying to resolve for ‘the second highest mountains’, as are no more left in this context to satisfy further POS-NP’s.

4.8 Summary and Final Remarks

The primary goal of this chapter is to provide a comprehensive account of the semantics of ordinals and superlatives using the DRT framework. As we have seen, this task touches upon many subjects that need to be further elaborated: The notion of articulated contexts as representation of the common ground raises issues such as how information is introduced to the common ground, and how it can be accessed and transferred between the different components; When dealing with referential presupposition triggers like the definite article, we are faced with the problem of selecting the most salient and relevant context component- but what are the rules that govern and guide our selection? This open-ended question is further complicated by the problem of contextual restriction- how do we decide which are the relevant entities to be considered for a quantificational/focus articulated/contextualized expression? To this, I have demonstrated with the example of topic-focus marked sentences, where upon construction of the focus frame, one may simply identify the focus set to the contextual restrictor, and select the comparison set from within. A generic lexical schema is arrived at for Singular Superlative NP's, Singular Ordinal Superlative NP's, and Singular Ordinal NP's. These lexical entries have been demonstrated to perform in a plausible syntax-semantic interface such that the correct semantic representations may be constructed for sentences involving the superlative and/or the ordinal.

The issue of Plural Superlative NP's calls a revision of the definite determiner, this solution alone, however, is not enough to deal with POS-NP's. A POS-NP further presupposes a partition of the comparison set. While the comparison set of the POS-NP itself is pre-ordered, every part of the partition is linearly ordered with regard to each other.

An interesting feature of the Plural Ordinal Superlative NP (and Plural Ordinal NP) is that it imposes further presuppositions about how other members of the comparison set should be arranged into different parts of the partition. So for example, given a context of five mountains where $\{m_1, m_2\}$ are of the highest degree, $\{m_3, m_4\}$ the second, and m_5 the third, once we refer to $\{m_1, m_2, m_3, m_4\}$ as 'the highest mountains', it is necessary that m_5 be referred later as 'the second highest' instead of, e.g, 'the third highest'.

Two very curious observations arise from our current analysis. First, consider the context of five mountains as before. Would it be possible to utter in the very beginning of a discourse, "the third highest mountain…", with the intention to refer to m_5? The answer is probably no, even though a partition would be consistent with our analysis. The reason here seems to me is that *too many steps of accommodation* are required- recall that accommodation is a context repair strategy that demands a certain amount of psychological effort from its users. Two steps of accommodations are needed in order for 'the third highest mountain' to successfully refer to m_5 in the given situation. One, the singular ordinal utterance presupposes that the comparison set is *linearly ordered* (Well Ordering), this is specified in (97). But if the comparison set is indeed linearly ordered, then it is forbidden for m_1 and m_2 to be under the same degree, and the same can be said about m_3 and m_4. So the first accommodation would be to abandon (97) and use (101) as an analysis for the singular expression 'the third highest mountain', but this is quite unnatural. Two, a partition is required (for m_1 to m_4) even though no plural ordinal has been uttered. Again (101) which is intended for plurals, must be used to represent a singular expression, while *ad hoc* sets are construed in order to fill in the parts resulting from the partition. The lesson from this first observation is that there is a strong preference to maintain contextual stability when a singular ordinal is uttered in the absence of other presuppositions (constraints related to the comparison set). To cancel the linear order presupposition and to introduce a partition to the comparison set would require an explicit utterance, entailment will not do.

The second observation is probably related to the first: Once again consider the context as before, when we are looking at those five mountains with their varying heights, does it really make any sense to refer to m_5 as 'the third highest mountain'? Wouldn't it be more intuitive to refer to m_5 as 'the fifth highest mountain' instead? Doing so would imply that we forego using the ordinal to refer to the relative high-ness of m_5 in relation to the rest of the mountains in the comparison set, but rather, we are counting the number of mountains that come before (as arranged by their high-ness) the one that is asserted. In certain contexts, this seems to be the only option: Consider a context where a married couple has three kids. The first two are identical twins, and the third born several years after. It would be required by convention to refer to the third child as 'the third' or 'the third oldest', even though by degrees of old-ness, she is in fact 'the second oldest'. On the other hand, either of the twins can be referred to by 'the oldest'. But then, where did 'the second oldest' go? Suppose another scenario where marathon runners compete, two finished at the same time and won the gold medal, and another who came in third received bronze. Do we refer to the third runner as 'the second fastest'? If the semantic analysis in this chapter is strictly followed, this should be the case. However, this is not how we conventionally refer to the bronze winner. Conventionally, we would regard him as 'the third fastest' of the marathon, like 'the third oldest child' in the example before.

It appears that for singular ordinals, the ordering is sometimes only indirectly tied to the comparison dimension (especially when convention interferes), and has more to do with the simple counting of the numbers of members in the comparison set that exists before the asserted ordinal itself. In other words, 'the n_{th} P_{est} N' suggests that N is not really the n_{th} in a hierarchy of N's pre-ordered according to their P degrees, but rather, it is merely the n_{th} counting from the beginning of the comparison set, a set which is ordered according to the P degrees. For a more comprehensive answer as to when one usage of the singular ordinal is preferred over the other, I will have to leave that to some large scale survey of the native speakers.

Chapter 5

Conclusion

5.1 Summary and Conclusion

The pursuit of a theory of presupposition spans more than a century. It started with a worry of Frege, who saw definite descriptions, as they are used in mathematics and elsewhere, as coming with the requirement, or presupposition, that their descriptive content is instantiated by a unique object. When this requirement is satisfied, the unique satisfier is the referent of the description. If it is not, then the description is without referent altogether. Any sentence containing such a non-denoting description is lacking a denotation as well: It doesn't denote a truth value, thus is neither true nor false.

Because of this, Frege saw non-denoting definite descriptions as a threat to his formalization of logic and number theory. The logical rules of his *Begriffsschrift* are based on the assumption that its sentences all have truth values. Sentences with non-denoting descriptions do not fit this logic, with possibly dire consequences.

Russell's Theory of Description offered a solution to Frege's problem by building the unique satisfaction requirements associated with definite descriptions into the truth conditions of the sentences containing them. Simple sentences with non-denoting descriptions are simply false. For instance, the sentence "the King of France is bald" carries the assertive force that "there is a unique King of France and he is bald". With logically complex sentences, such as negations, denotation failure may have another effect on the truth conditions.

Strawson argued that the Theory of Descriptions doesn't do justice to the way in which definite descriptions are used. Many uses of sentences with non-denoting descriptions are perceived by us as failing to have a well-defined content they do not express propositions, and since propositions are the carriers of truth values, such uses are neither true nor false, much as Frege had claimed about sentences with non-denoting descriptions. Strawson also made a further distinction that between sentences and utterances of sentences, and with that the distinction between sentence meaning and propositional content. It is utterances of sentences that have propositional content, or fail to have it. And when the sentence uttered contains a definite description which in the context of utterance fails to denote, then the utterance of the sentence fails to express a propositional content as well, and so the question of truth or falsity doesn't arise. But even when a given utterance of a sentence S fails to express a propositional content, S itself may well be meaningful. An example is Russell's "The King of France is bald". Uttered in the 20_{th} century the description fails to denote and the sentence doesn't express a proposition. But utterances before the middle of the 18_{th} century were different. Then the description did have a proper denotation, the utterance did express a propositional content and it was true or false as the denoted King was or wasn't bald.

Thus Strawson revived the Fregean notion that definite descriptions carry a presupposition of unique satisfaction. If this presupposition is not satisfied for a description when a sentence containing the description is being uttered, then the utterance lacks a truth value. And if the presupposition is independent from the circumstances in which the description can be used, as is wont to be ??? the case in mathematics, then if it fails, any utterance of a sentence containing it will be without a truth value and the sentence can be said to lack a truth value as such.

Not long after Strawson's revival of Frege's presuppositional view of definite descriptions linguists began to realize that the same phenomenon- unless certain conditions are satisfied (in the context in which a sentence is uttered), the utterance cannot be regarded as either true or false- is not restricted to the unique satisfaction conditions associated with them, but something much more general. Besides definite descriptions there are many more *presupposition triggers*- words and grammatical constructions that bring conditions into play that must be satisfied in the context in which they are used lest the sentential utterances of which they are part fail to determine a well-defined truth value. At that point, presupposition theory, much as we know it today, was born. And the question whether definite descriptions are better treated as presuppositional in the spirit of Frege-Strawson or in the non-presuppositional manner of Russell's description theory had lost much of its methodological importance: Even adopting the Russellian line would not make all the other, newly discovered cases of presupposition go away.

Chapter 1 begins with a brief account of the *semantic view* on presuppositions, which is generally attributed to Frege and especially Strawson, according to which presupposition is defined in terms of entailment. If a constituent of a sentence ϕ triggers a presupposition ψ, if in any context in which ψ is false, an utterance of ϕ can be neither true nor false. Or, simplifying by keeping the context fixed, if ψ is false, ϕ is neither true nor false. Contraposing from this we get that when ϕ is true then ψ must be true, and when ϕ is false ψ must also be true. That is, ψ is entailed both by ϕ and by the negation of ϕ. In classical logic this is possible only if ψ is logically true. But clearly that isn't normally the case. For instance the statement that there is a unique king of France- the presupposition triggered by the description *the King of France* is not a tautology. This suggests that the logic of a language with presupposition-triggering expressions can't be classical. Much effort has been wasted on finding a non-classical presupposition logic that allows that a formula ψ can be entailed both by a sentence ϕ and by its negation $\neg\phi$ without being a logical truth (i.e. without being entailed by the empty premise set). The entailment-based definition of *presupposition* should be distinguished from the principle that presuppositions are triggered by particular words and constructions. This latter view has survived to this day and is now an integral part of most presupposition accounts.

The empirical basis for claims that it is part of the linguistic properties of certain words and constructions that they trigger certain presuppositions is a battery of presupposition tests. Suppose that sentence ϕ contains an expression that is claimed to trigger the presupposition ψ. That claim will be either confirmed or refuted by the different tests. For instance, it should not only be the case that an assertion of ϕ carries the implication that ψ, but that an assertion of not-ϕ also carries the implication that ψ. Or a second test when someone asks you the question "Is it the case that ϕ?", and you know that ψ is not true, then you cannot in good conscience answer with either 'yes' or 'no'; and likewise for the other tests in the battery. Chapter 1 presents a range of these tests and discusses how a variety of (putative) presuppositions fare in relation to them.

A very different view of the nature of presupposition is the so-called *pragmatic view*. According to this view presuppositions are assumptions made by a speaker when making an utterance. In making these assumptions the speaker creates a context for his utterance which enables him to express what he wants to say in ways that would not be possible without those assumptions. And what he says can then be understood as modifying the context he has been assuming in adding its non-presuppositional content to the assumed context. This view is primarily associated with the name of Stalnaker (e.g. Stalnaker, 1974).

In most contemporary presupposition theories the opposition between the pragmatic and the semantic view has largely disappeared: Certain expressions- words and constructions- carry presuppositions: That is just an intrinsic feature of the language to which they belong. But speakers know their language, so they know in particular which presuppositions are carried by which expressions, and so they will as a rule make sure that the contexts in which they use presupposition-carrying expressions satisfy the presuppositions triggered by those expressions, or convey that this is the kind of context they are assuming: By and large the pragmatic presupposition behaviour of speakers will be in accord with the presupposition-determining rules of the language they use.

Since the late sixties linguistic work on presuppositions has to a large extent been guided by the *Projection Problem*. It sometimes happens that the presuppositions triggered by certain expressions, confirmed by application of the presupposition tests to simple sentences containing these expressions, differ when these simple sentences are integrated into larger, logically complex sentences something that can be confirmed once more by applying the same tests. In such cases the triggered presuppositions do not *project*, as the technical term has it- they do not survive as presuppositions of the logically complex sentence as a whole. By now there is much about the Projection Problem that has been quite well understood. Largely this progress has been due to work in the Dynamic Semantics tradition- starting with Karttunen (1974) and then unfolding in a formally more explicit form in the accounts of Heim (1983b) and Van Der Sandt (1992). These last two accounts are making use of two closely related formal frameworks- File Change Semantics (Heim, 1983a), and Discourse Representation Theory (DRT) (Kamp, 1981).

The general solution that Dynamic accounts of presupposition offer for the Projection Problem is based on the notion of *local contexts* that is an intrinsic feature of the frameworks they make use of. According to these frameworks, certain parts of complex sentences provide 'local' contexts for the interpretation of other parts of the same sentence. When such a local context for a given sentence part entails a presupposition triggered within that part, then the presupposition is 'locally taken care of' and consequently does not manifest itself higher up: It does not project.

Since the general approach of this dissertation makes use of Dynamic Semantics, both frameworks are introduced in Chapter 1. More specifically, the proposals I will be making are couched within DRT. In this framework, presuppositions are treated in much the same way as pronominal anaphors (the expressions to which DRT in its original form was primarily applied) and resolved using the same mechanism- by seeking from within the discourse context a *suitable* antecedent and identifying the anaphor with it (van der Sandt, 1992). Two important features in this approach are unprecedented and provide leeway to solving problems that Heim, Stalnaker, and others were unable to solve. First, it takes advantage of an inherent structural property of DRSs: The structural relation between the position in which a presupposition trigger is represented in a Discourse Representation Structure (DRS), and the position in which its antecedent is represented. The antecedent must be located somewhere along the *anaphoric accessibility path* leading upwards from the representation of the trigger and its presupposition to the top level of the sentence representation. And the second feature: The availability of a formal apparatus which we may use to spell out exactly how binding and accommodation should be performed on different contexts.

Van der Sandt made use of the projection path to define a very specific algorithm for the binding and accommodation of presuppositions. This algorithm appears to be the most problematic part of his account. On the one hand, some of the predictions made by this algorithm do not seem to be correct. Some of the principles he formulated fall far short of dealing with many of the details of presupposition resolution, ignoring both the diverse variety of factors that play a part in the resolution of just one type of presupposition (viz. those triggered by definite descriptions) and on the other with the differences in resolution options that apparently exist for presupposition of different types (identifiable in terms of the words or constructions that trigger them).

Chapter 2 is devoted to a comprehensive overview of the current issues that arise out of the anaphoric treatment of presuppositions in DRT. The majority of these issues can be categorized into two classes. First, van der Sandt's exploitation of DRT's inherent structural properties is limited to manipulating the information already existing within the different logical scopes of the discourse. Information that is external to the utterance and its discourse context cannot be brought into play. This becomes a problem when *accommodation* is needed- what information is available for accommodation? Where does it come form? This question is non-trivial because often what speakers accommodate is often not the presupposition itself but information from which the presupposition follows. This is so especially when *bridging* is involved. Furthermore, the criteria needed to choose the right binding candidate often depend on world knowledge and situational information that aren't part of the discourse context as it is defined in standard DRT (including the versions that van Der Sandt and other presupposition theorists who have been using a DRT-framework have been assuming). Clear illustrations of this problem are cases discussed in Chapter 3 which concern the resolution of definite descriptions, especially those involving *partial match*, when the presuppositional anaphor has in common with its textual antecedent certain conditions that make them suitable for binding, but more information is often needed to verify the anaphoric link between them. (For more on Chapter 3, see below.) The second class of problems with the anaphoric treatment of presuppositions has to do with certain technicalities within van der Sandt's theory and the way in which it is formalized. As indicated in the last paragraph, the theory does give us means to address the problem of choice between different resolution alternatives. Here, a refinement is needed of the existing resolution preferences and constraints, and the formulation of these refinement require an extension of the theory's conceptual repertoire. New concepts are needed especially and specifically in connection with *Presupposition Cancelation* (Horn, 1985; 1989) and *Presupposition Filtering* (Karttunen, 1973).

In addition, there are some important aspects of presuppositions that are rarely discussed in the literature. One has to do with *presupposition interaction*. The majority of presupposition studies tend to focus on the projection problem and concentrate on a single presupposition trigger. An overlooked aspect is the interaction between multiple triggers, usually found embedded within one another. Some examples of this are given in Chapter 2. One of these specifically deals with the interaction between the different scopes of the trigger 'again' with an embedded possessive NP[1]. Due to the interaction, at least four different readings are possible. In order to be able to analyze how presuppositions interact, we must first know how the representations of presuppositions are actually computed. This is why a DRT-based approach in which the computation of presupposition representations constitutes an essential aspect of the account over-all, and it is the reason why DRT is particularly suitable for the investigation of this aspect of presupposition theory.

Most presupposition triggers are single words. When a presupposition is specific to a particular word, then it must be part of the lexical specification of that word- i.e. of its lexical entry- to articulate all that is distinctive about the presuppositions it triggers: How the presuppositions it generates in different syntactic environments can be computed, and how they can be bound or accommodated in different contexts. This raises questions about the content and form of lexical entries which thus far have hardly been discussed (either in the literature on presuppositions or in that on lexical semantics). This dissertation explores that question particularly in relation to one presupposition trigger, viz. definite descriptions. English definite descriptions are expressions formed with the help of the definite article *the*. So it is the semantics of *the*

[1]The example can be found in (58a)

that can be held responsible for the semantics of definite descriptions (as opposed to that of other Determiner Phrases that can be built from the same Nominal Phrases, e.g. *the man* and *the men* as opposed to *a man, three men, every man, most men*).

Chapter 3, which is entirely devoted to definite descriptions, can be seen as part of the quest for all that goes into the specification of the semantics of *the*. Its first concern is with laying out a formal framework that any serious investigation into the form and content of lexical entries should come to bear. The form of a lexical entry must be such that the information encoded in it can be used directly in the construction of semantic representations for the larger sentences in which the word occurs. This means that the form of such entries must be attuned to the form of the semantic sentence representations and the principles according to which those representations are computed from the representations of their parts. To address questions of lexical form in detail we therefore must commit ourselves to some account of the form and computations of sentence representations. In this regard, we adopt a "Box + λ" framework (Blackburn & Bos, 1999). This framework takes the syntactic trees generated by simple GPSG rules as input. Each node on the syntactic structure is annotated with a semantic representation, a DRS. The leaf nodes are lexical entries, each represented by a lambda DRS, and all nodes except the root are intermediate stages of the semantic construction. The construction process is bottom-up in the Box + λ framework, with lexical entries being the most basic building block. The outcome of this construction is a *Preliminary DRS*. A Preliminary DRS is the semantic representation of a given utterance. For an utterance *with* presupposition triggers, it will contain unresolved presuppositions at the end of the Box + λ construction. Representations of presuppositions are always left-adjoined to the representation of assertive content of the sentence part where those presuppositions are triggered. These presuppositions are dealt with during the semantic-pragmatic phase in which trigger-specific algorithms defined within the lexical entries of those triggers will guide and govern the resolution procedures.

Once a general syntax-semantics interface is made available, we are left with defining the lexical entry of the definite article. This task is two-fold. First, we must draw up its semantic content so that the presuppositional and non-presuppositional content are accurately represented in the Preliminary DRS. And secondly, we need to determine the principles according to which the presuppositions of definite descriptions are resolved.

As regards the presuppositions of definite descriptions two observations are in order. (i) Link (1983) proposes an analysis of the definite article according to which definite description always denote the totalities of the satisfiers of their descriptive contents. (For Link, these are the mereological sums of their satisfiers.) This assumption carries the ‘existence’ presupposition that the descriptive content has one or more satisfiers. It is this, and only this, that is needed as part of the entry of number-neutral *the*. When *the* is combined with the feature ‘singular’, yielding a definite description that is morphologically singular, then this feature adds the presupposition that the referent is ‘atomic’, i.e. is a single individual; this then entails the uniqueness presupposition of singular definite descriptions. The feature ‘plural’ contributes the presupposition that the referent consists of more than one individual. (ii) It is obvious, and has long been realized, that the uniqueness presuppositions of singular definite descriptions are not often satisfied when they are applied to the descriptive content of the description as such, but only when this description is conjoined with some implicit predicate C that has to be recovered from the context. In the entry for *the* proposed in Chapter 3, both (i) and (ii) have been adopted. In this entry there are two presuppositional elements: (a) that the referent is the totality (or mereological sum) of the satisfiers of the descriptive content. (This entails an existence presupposition). (b) A presupposition associated with the predicate C that is part of the descriptive content, to the effect that C must be resolved in context.

More needs saying about the second task. According to van Der Sandt presuppositions can be either bound or accommodated. That statement is misleading insofar as it suggests that the choice is between whole-sale binding and whole-sale accommodation. Often presupposition resolution involves a combination of binding *and* accommodation. This is true also for presuppositions of definite descriptions. Binding of such a presupposition in Van Der Sandt's sense usually take the form of finding a discourse referent y in the discourse context (or in the locale context of the preliminary representation that also contains the presupposition itself) with which the discourse referent x that represents the referent of the description can be identified. But under what conditions are such identifications permitted, or required? It turns out that a number of distinction have to be made in this connection, and it is this that is the central concern of Chapter 3. Among the cases considered in the Chapter, there are in particular some that require accommodation of some of the properties that the description attributes to its referent to the discourse referent of the candidate antecedent before the actual identification can take place. These, then, are resolutions of definite descriptions involving binding and accommodation. But the kind of accommodation that takes place in these cases- accommodation of properties- is to be distinguished from accommodation of new discourse referents. Resolution of the presuppositions of definite descriptions can involve this second type of accommodation too. But that appears to be a quite different process, although the difference between the two processes is not yet very well understood.

How the presupposition of a definite description is resolved depends on the relations that obtain between the description and the different noun phrases that are available as potential antecedents for it. There are various ways in which these relations can be analyzed. Chapter 3 focuses on two, an *entailment-based* analysis, which compares the intensions of the descriptive contents, and a *form-based* analysis, which compares the surface structures of the descriptive forms of description and potential antecedent and looks primarily for matching words. These classifications become especially important when there is more than one candidate competing for the role of antecedent. A good part of Chapter 3 focuses on the factors that are involved in the antecedent selections that such cases require. As a rule the selection will depend on a comparison of the relations in which the given description stands to the different candidates. There is an interesting interaction between the entailment-based and the form-based classification schemes, with selection determined by entailment-based classification playing the primary and form-based classification a secondary role, which becomes decisive in those cases where entailment-based principles do not designate a clear winner.

The investigations of Chapter 3 do not settle all questions about antecedent selection in a definitive way, but they reveal much about the mechanisms involved in reference resolution for definite descriptions that most studies of presupposition resolution simply ignore.

Another case study is carried out in Chapter 4. It too is concerned with definite descriptions, but definite descriptions of quite special kinds. There are three kinds, distinguished by the form of their descriptive part (their NP part in current syntactic terminology): (i) the NP consists of a head noun N preceded by an ordinal adjective ('first', 'second', 'third', ...); (ii) the NP consists of N preceded by a superlative ('highest', 'latest', 'darkest', ...); (iii) the NP consists of N preceded by an ordinal followed by a superlative ('third highest', 'second biggest', ...). Moreover, definite descriptions of types (ii) and (iii) come in two versions, singular and plural. (Plural descriptions of type (i) are possible as well. But they seem special in a way that the others are not; Chapter 4 does not consider them.)

These descriptions are interesting from the perspective of presupposition theory generally, since their adjectives are presuppositional in their own right and their presuppositions interact with those that are associated with definite descriptions of any sort. The ordinal adjective n_{th} preceding the noun N presupposes that there is an ordered set <X, <> such that X is a set of N's and the cardinality of X is at least n. Moreover, X must be the intersection of the set of all N's with the extension of the contextually retrievable predicate C that is part of the presuppositions contributed by *the*. Thus retrieval of C and X must be dovetailed, and in addition the interpreter must be able to retrieve the ordering < of X. The semantics of n_{th} is then that its selects the n_{th} member of X as making up the (singleton) extension of 'n_{th} N'. This means that the descriptive part of 'the n_{th} N' has a unique satisfier. So the unique satisfaction presupposition of *the* is fulfilled and the description properly denotes 'the n_{th} X'.

Up to a point the story about superlatives is similar. Superlatives presuppose a ‘comparison set’- a set of satisfiers of the head noun N from which the superlative then selects its extension. And here too this set is the set of those N’s that belong to the extension of the context predicate C; and here too the selection involves an order. But this time the order does not need to be retrieved from context since it is given by the description itself, viz. by the meaning of the adjective. Adjectives to which the superlative operator can be applied must be graded; a graded adjective is one that assigns degrees to the objects in its domain and thereby imposes an ordering on them that is defined by the degrees it assigns to them. Extension selection is different in this case. The predicate preceding N (i.e. the superlative form of the adjective) selects a subset Y of the comparison set X such that every member of Y has a degree that is greater than that of every member in the set X - Y. If the description is in the singular (‘the highest N’), then, as usual, the feature ‘singular’ will impose on Y the restriction that it be a singleton. The effect of this is that the referent of the description is that one member of the comparison set that is higher than all other members in that set (it is part of the presupposition that there is just one such member, i.e. that there are no ties at the top). Similarly, the plural description ‘the highest N’s’ must refer to a set of more than one member of the comparison set, but the members in that set must all be higher than everyone of the remaining members of the comparison set. This too is an agreement with our intuitions.

Descriptions of type (iii), such as ‘the n_{th} highest N’, involve a new twist. Here we have, in addition to the definite determiner, two presupposition triggers, the ordinal and the superlative. Intuitively the meaning of the combination ordinal + superlative is that there is a way of ordering satisfiers of the complex predicate ‘highest N’: There is the ‘[(first) [highest N]]’, the ‘[second [highest N]]’, and so on. The extension of ‘(first) highest N’ is the highest tier of the comparison set; that of ‘[second [highest N]]’ is the highest tier of what is left of the comparison set after the first tier has been removed, and so on. In such ordinal-superlative combinations the ordered set presupposed by the ordinal and the comparison set presupposed by the superlative are intimately related to each other as well as to the extension of C. In fact, because each of them must be identical with the intersection of the extensions of N and C, the two sets must be the same; moreover, the order of the ordered set presupposed by the ordinal must be identified with the order defined by the adjective. (It is not clear whether a completely compositional analysis is possible for this construction, which requires no special stipulations that pertain just to ordinal-superlative combinations. I doubt that such an analysis can be given.)

For descriptions of this third type we must also distinguish between singulars and plurals. The plural descriptions reveal a further point of interest. Consider a more concrete example, involving a set of five mountains, ranked as follows according to their heights: $<m_1, m_2, m_3, m_4, m_5>$. Suppose that a speaker referring to this set, starts the discourse by saying :"I climbed the second highest mountains". It seems that in saying this he can use the phrase 'the second highest mountains ' to refer to the set $\{m_3, m_4\}$, thereby treating that set as the second tier from a three tier partition of the five mountains. He can then go on and use 'the highest mountains' to refer to $\{m_1, m_2\}$ and 'the third highest mountain' to refer to m_5. What does not seem possible is for the speaker to start as he did and then to use 'the highest mountains' to refer to $\{m_1, m_2, m_3\}$, now treating the first three mountains as constituting the first tier. That is, it is part of the information that is fixed in the context (and that should ideally be retrievable by the addressee) that the comparison set is ordered in some particular way. The order need not be a linear one- it can be a 'tier order'. But it counts as fixed in the context, and there is no way of switching to a different order in midstream, at least not without giving explicit warning to one's co-travelers.

These are just some of the intriguing phenomena that can be observed in connection with ordinal and superlative descriptions. But they should suffice to give a flavor of the kinds of interactions that can occur between presuppositions that are generated by different presupposition triggers. One kind of interaction is 'joint resolution': Resolutions of two or more presuppositions prefer use of the same contextually available entities to fulfill more than one resolution requirement at once.

There is also another respect in which the case study of Chapter 4 differs from that of Chapter 3. In Chapter 3, presupposition resolution for descriptions is considered solely in relation to the discourse context (only 'anaphoric' resolutions are considered there). In Chapter 4, the question is raised how descriptions may be resolved by using contextual information of other than that belonging to the discourse context, e.g. information that was already part of the common ground between speaker and hearer when their conversation began, and which might stem from earlier experiences they shared or belong to the common culture in which both are immersed. In raising this question use is made of a formal notion of context which covers contextual information other than that from the discourse context. This is the notion of an *Articulated Context* as developed in (Kamp, 2006). Articulated contexts consist of several interconnected components, of which the discourse context is only one. These components either have the form of a DRS (this is true for the discourse context), or as collection of DRS-like representations of entities. For instance, the *encyclopaedic* context component, which acts as a repository of entities familiar to the discourse participants on the basis of earlier joint experiences and of their shared culture, and the *environmental* context component, a repository of entities in the immediate environment that are perceptually accessible to the participants, both consist of such entity representations.

Articulated contexts allow us to analyze how the resolution possibilities for different types of definite noun phrases- pronouns, definite descriptions, names, demonstratives- vary in terms of the contextual resources that may be used to resolve their presuppositions. In this respect, definite descriptions appear to be at one extreme of a spectrum: Resolution of their presuppositions can make use of any articulated context component whatever. What we see here is yet another dimension to the question what forms presupposition resolution can take: One way in which presuppositions may vary has to do with the kind of information that may be used to resolve them. (The matter is reminiscent of Kripke's insistence on the 'anaphoric' nature of certain presuppositions. But an exploration of that connection is for another occasion).

The case studies in this dissertation are all concerned with definite descriptions. That looks like a small corner of a very large field, when we keep in mind how many different presuppositions and presupposition triggers are currently acknowledged. Even so, these case studies have revealed quite a number of different issues, and some of those do not seem to have drawn the attention of presupposition theorists before. How representative the phenomena I have discussed are for the field as a whole can at this point only be a matter for speculation. One would hope that the same issues and patterns will show up again and again when other presuppositions will be subjected to similar scrutiny; but who knows?

A central theme in the explorations of presupposition resolution principles of Chapters 3 and 4 is the interaction between presupposition and context. Much of what I have tried to force into the open through those explorations has to do with those interactions. I have gone through this effort out of the conviction that the interactions between contexts and lexically triggered presuppositions are an important part of the semantics of the words responsible for those presuppositions. Of course this is an aspect of meaning that can be found only with those words that trigger presuppositions. But given that so many presupposition triggers are words, and that so many words are presupposition triggers, it is an aspect that, while it isn't universal, affects enough of the lexicon to count as a significant dimension of lexical meaning generally.

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