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RESEARCH ARTICLE

Parasitic scope

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Abstract I propose the first strictly compositional semantic account of *same*. New data, including especially NP-internal uses such as *two men with the same name,* suggests that *same* in its basic use is a quantificational element taking scope over nominals. Given type-lifting as a generally available mechanism, I show that this follows naturally from the fact that *same* is an adjective. Independently-motivated assumptions extend the analysis to standard examples such as *Anna and Bill read the same book* via a mechanism I call PARASITIC SCOPE, in which the scope of *same* depends on the scope of some other scope-taking element in the sentence. Although I will initially discuss the analysis in terms of a familiar Quantifier Raising framework, I go on to implement the analysis within an innovative continuation-based Type-Logical Grammar. The empirical payoff for dealing in continuations is that a simple generalization of the basic analysis gives the first ever formal account of cases in which *same* distributes over objects other than NP denotations, as in the relevant interpretation of *John hit and killed the same man*.

Keywords Parasitic scope · Quantification · Continuations · Quantifier raising · Type logical grammar · Same · Different

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1 A compositional semantic account of *same*

> [*Same* and *different*] *appear to be totally resistant to a strictly compositional semantic analysis*... Stump (1982:2).

This paper seeks to understand the semantic behavior of *same* (with more limited discussions of some related adjectives, notably *different*) in a variety of its most typical uses, including (1):

(1) Anna and Bill read the same book.

There is a deictic reading of (1) that depends on identifying some contextually-salient book (see Sect. 1.1). The central topic of this paper, however, is a distinct interpretation on which a use of (1) will be true just in case there exists some book x—any book x—such that Anna read x and Bill read x. Carlson (1987) calls this second type of interpretation an INTERNAL reading, which he describes (p. 532) as a case in which "the sentence, in some way or other, provides its own context".

Remarkably, as far as I know, there has never been a compositional semantic analysis of the internal reading of sentences like (1).

The lack of a compositional analysis is certainly not because *same* is in any way exotic or rare; quite the contrary, *same* lives at the deepest, most basic stratum of English, and is perfectly natural across all registers and dialects (and likewise for analogous expressions in other languages). Furthermore, children learn to use *same* early and effortlessly, which makes it all the more puzzling that current semantic theories have such difficulty accounting for its behavior.

Nor is there any paralyzing uncertainty about what the truth conditions are, at least for relatively simple examples like (1). Setting aside the vagueness inherent in deciding how similar two objects have to be in order to count as the same (see Sect. 1.2), the truth conditions of (1) are clear and robust. Indeed, the stark difference in meaning between (1) and the same sentence with *same* removed (i.e., *Anna and Bill read the book*) is exactly the sort of meaning difference that semanticists are usually most eager to analyze.

Indeed, standard semantic techniques seem to lead to a dead end. Keenan even (astonishingly!) proves that there is no compositional analysis based on generalized quantifiers that can possibly express the internal meaning of (1).

However, Keenan's result does not mean that *same* is non-compositional; all it shows is that the meaning of *same* cannot be expressed purely in terms of generalized quantifiers. But after all, *same* is an adjective (occurs after a determiner, takes an intensifier (*the very same book*)), and certainly is not an NP. I suggest below that the behavior of *same* falls out once we recognize that it is a scope-taking adjective, and not an NP. In fact, I argue in Sect. 5 that the existence of such scope-taking adjectives arises quite naturally in any system that recognizes LIFT as a legitimate type-shifting operation (in the presence of a sufficiently general theory of scope-taking).

As emphasized by Carlson (1987), the conditions under which *same* takes scope often depend on the presence of other scope-taking elements elsewhere in the sentence.

(2) a. The same waiter served John.
  b. The same waiter served everyone. [Stump, Heim]

The standard judgment (and my own intuition) is that (2b) has a sentence-internal interpretation that (2a) lacks. It seems clear that the availability of the additional reading has something to do with the fact that *everyone* is quantificational. I will argue that the scope of *same* depends on the scope of *everyone* in a certain way that I will call PARASITIC SCOPE, for reasons that will become clear in Sect. 6.

I should hasten to say that even though *same* has not received an analysis that is both compositional and semantic, it has received insightful analyses that are either compositional or semantic. Among the compositional analyses are Dowty (1985) and also Beck's (2000) analysis of *different*, both of which rely heavily on pragmatically-controlled free variables. Relying on free variables simplifies the combinatorics, at the cost of denying that there is any formal link between, for instance, the denotation of *Anna and Bill* in (1) and the properties that pick out the book in question on the internal reading.

Of course, whether an analysis ought to be semantic (i.e., combinatoric) or else pragmatic (in this case, relying on free variables) is legitimately debatable. I provide arguments below in Sect. 3 that pragmatic approaches have empirical shortcomings compared to the semantic approach developed below.

There are also explicit formal analyses that are semantic (combinatoric) but not compositional, including Stump's (1982) pioneering treatment, Moltmann (1992), and van Eijck (2003). These analyses either allow for side calculations carried out in parallel with normal composition (Stump, Moltmann), or else combine discontinuous NPs into higher-order ("n-ary") quantifiers, i.e., treat *Anna and Bill ... the same book* as a semantic unit, as in van Eijck, building on suggestions in Keenan (1992). As each of these authors point out, the reason these analyses fail to be compositional is that they require combining elements semantically in an order that is incompatible with gross syntactic constituency.

Now, whether a particular phenomenon ought to be treated compositionally is also open to debate, though the decision may ultimately depend on methodological preference. But it is one thing to resort to a non-compositional analysis when it is the only type of analysis available, and quite another to do so when a compositional analysis exists. So one important goal of this paper is to show that a strictly compositional semantic analysis is in fact possible (and not only possible, but appealing).

Finally, I should also note that there are insightful discussions of *same* and *different* that assume that a compositional semantic analysis is possible, but do not provide complete details, notably Carlson (1987; see especially remarks on pages 531, 541, 545). In some sense, then, the analysis below justifies Carlson's optimism that a compositional semantic account exists. As may already be clear, I have relied heavily on Carlson's insights at every stage in the research reported here, especially concerning the relationship between distributivity and adjectives like *same*. However, the analysis below departs from some of Carlson's main hypotheses in other ways; in particular, the NP-internal uses of *same* discussed below (e.g., *two men with the same name*) show that *same* does not require any direct reference to events, one of Carlson's main conclusions.

Although I initially develop the analysis below in terms of quantifier raising at LF in the style of Heim and Kratzer (1998), in part for the sake of expository familiarity, the analysis does not depend in any essential way on positing a distinct level of LF. I demonstrate this by translating the analysis into a continuation-based Type Logical Grammar in the style of Moortgat (1997). The empirical payoff for switching to a continuation-based treatment is the first-ever formal account of examples in which *same* distributes over non-NP denotations, as in the relevant reading of *John hit and killed the same man*.

I believe that it is no accident that the first compositional semantic account of *same* falls out from a continuation-based approach. Continuations are a technique originally developed for studying the semantics of programming languages. I will not devote much space here to motivating or characterizing continuations (see Barker 2002; de Groote 2001; Shan and Barker 2006; Barker and Shan 2006; and references there), concentrating instead on explaining the behavior of *same*. Nevertheless, one of my main motivations for studying *same* is to provide support for the claim that continuations provide new and valuable insights into the nature of scope-taking.

I will conclude that despite Stump's pessimism and Keenan's discouraging proof, *same* does in fact have a perfectly reasonable strictly compositional semantic treatment, and that the discovery of such an analysis supports the claim that continuations are ideally suited for reasoning about scope-taking.

1.1 First preliminary: deictic *same*

Same always has a deictic use that depends on identifying some salient object present in the discourse context. For instance, if Ivan holds up a copy of Jane Austen's *Emma*, Jorge might utter (8):

(3) Hey, I just read the same book!

In the described situation, it is appropriate to assume that *same* conveys the property that an object has if it is held by Ivan. And in fact, this kind of context-dependent reading is the only interpretation *same* has in (3).

But if there is a plural NP in the sentence, another interpretation emerges:

(4) a. Anna and Bill read the same book. (same as (1))
b. Anna and Bill read the held-by-Ivan book. **Deictic**
c. Anna and Bill read the read-by-Anna-and-Bill book. **Internal**

In the same situation described for (3), (4a) can certainly have a deictic use as paraphrased in (4b) that asserts that Anna and Bill read the book that Ivan is holding. But (as discussed above) there is another, "internal", interpretation, as paraphrased in (4c) on which (4a) is true whenever there is some book that Anna and Bill each read.

Like most authors (though by no means all, e.g., Dowty (1985)), I will assume that the internal reading is a systematic interpretation distinct from the deictic uses, and that it requires a formal grammatical account. I will argue explicitly against attempting to unify the internal and deictic uses in Sect. 3.

Carlson notes that one of the key differences between the deictic use and the internal use is that an internal use is only possible if the trigger NP is interpreted distributively. That is, the interpretation in (4b) is consistent with Anna and Bill reading the book collaboratively, but the internal reading in (4c) entails that Anna and Bill each read the book independently. As Carlson also noted, although there must always be some element for internal *same* to distribute over, it need not be an NP meaning (for example, *John read and reviewed the same book*). Such uses with non-NP triggers are discussed in Sect. 4 and analyzed in Sect. 7.

1.2 Second preliminary: types versus tokens

One fascinating aspect of the semantics of *same* (and similar expressions such as *different*, *opposite*, etc.) is variation in just how similar two objects have to be in order to count as the same (or how different, etc.).

(5) I drive a Ford Falcon and Enzo drives the same car.

For instance, as Nunberg (1984) notes, (5) can be true even though the speaker and Enzo drive different objects, as long as both cars have the same make and model. In other words, the cars need only be type-identical, not token-identical. Lasersohn (2000), discussing Nunberg's account, persuasively argues that the difference between type identity and token identity is a difference in degree, not in kind. In any case, I will assume that this phenomenon is orthogonal to the compositional issues discussed here, and will play no further part in this paper.

2 Beyond the Frege boundary

Keenan (1992) proves there is no set of generalized quantifiers that can be used to compose the truth conditions of (6a) (on the internal reading).

(6) Anna and Bill read the same two books.

To see the form of the proof, it is necessary to view the sequence of NPs *Anna and Bill … the same two books* as a discontinuous predicate over relations. For instance, in (6a), this sequence combines with the transitive verb *read* to form a complete sentence. In Keenan's terminology, an NP sequence is REDUCIBLE if it can be decomposed into separate generalized quantifiers that accurately reflect the truth conditions of the original complex expression. So the main question here is whether the sequence *Anna and Bill … the same two books* is reducible. If not, then according to Keenan, the NP sequence lies "beyond the Frege boundary".

Keenan answers this question by proving Reducibility Equivalence: if two sequences are reducible, and if they yield the same truth value whenever the transitive verb meaning happens to be a cross product, then the two sequences must be completely equivalent, i.e., give the same result for every transitive verb meaning.

(7) a. Anna and Bill read the same two books.
b. (Both) Anna and Bill read exactly two books.

In order to prove that NPs containing *same* are not reducible, Keenan's strategy is as follows: we first establish that the sequences *Anna and Bill … the same two books* and *Both Anna and Bill … exactly two books* yield the same truth value for any cross-product relation, and then we observe that they give different truth values on at least one other (non-cross-product) relation.

The first step is to establish that the two sequences give the same result for any cross-product relation. If *read* denotes a cross product, then every reader in the domain reads every book. In any situation in which there are more than two books, both (7a) and (7b) will be false. This is because when *read* denotes a cross product, Anna and Bill will each have read every book in the domain, and if there are more than two books, that will falsify both sentences. Similarly, in any situation in which there are fewer than two books, both sentences will be false. Therefore, assume that there are exactly two relevant books. Because *read* is a cross product, Anna and Bill (or however many people end up in subject position) each read both books; this is sufficient to satisfy the truth conditions of both sentences. Thus (7a) and (7b) are defined (felicitous) over the same set of models, and they yield the same truth value for any relation that is a cross product.

By Reducibility Equivalence, if the sequence *Anna and Bill … the same two books* is reducible, then (7a) and (7b) must be synonymous. The next step, then, is to show that there is at least one possible (non cross-product) relation for which the two sentences are not synonymous. Therefore imagine that Anna reads exactly two books, and that Bill also reads exactly two books, but the books Anna reads are different than the books that Bill reads. Then (7a) is false (they didn't read the same books), but (7b) is true (they read exactly two books each). Assuming that all of the other NPs involved (*Anna* *and Bill, both Anna and Bill*, and *exactly two books*) can be adequately rendered by garden variety generalized quantifiers as in, say, Barwise and Cooper (1981), we can deduce that *the same two books* cannot be adequately translated by any generalized quantifier, and furthermore that the culprit must be the presence of *same*.

Proofs of Reducibility Equivalence and additional details concerning this specific pair of examples can be found both in Keenan (1992) and also in Dekker (2003); see also van Eijck (2004) for additional results concerning reducibility.

Given Keenan's result, how could there be any compositional analysis? One possible answer is that we could recognize the existence of discontinuous (i.e., non-compositional) quantifiers such as *Anna and Bill ... the same two books*. This is in effect the proposal of Stump (1982). As the analysis of a sentence proceeds, Stump places each NP onto a Cooper store. Certain types of NP, including NPs containing *same*, are able to interact with other NPs while in the store, in effect forming a discontinuous constituent. Later, the sequence of NPs can be cashed out and applied to a transitive verb meaning. Van Eijck (2003), building on suggestions of Keenan (1992), proposes a similar strategy.

Discontinuous quantifier strategies are perfectly coherent and precise, and they are weakly compositional in the sense that the meaning of the whole depends on the meanings of the parts. But they are certainly not directly compositional in the sense of, e.g., Jacobson (1999). Direct compositionality is a particularly strict form of compositionality on which each syntactic constituent has a denotation that depends only on the meanings of its immediate subconstituents. So unless it is possible to justify *Anna and Bill ... the same two books* as a syntactic constituent (which seems unlikely), we must conclude that the analyses of Stump and van Eijck fail to be compositional.

A second possible answer, and the one pursued here, is that Keenan's result only bears on the possibility of reducing NP meanings to normal (what he calls type <1>) generalized quantifiers. If we allow NPs to denote objects other than generalized quantifiers, Keenan's result does not apply. I will argue below that although *same* does take scope, it is not a generalized quantifier. But this should not be surprising: after all, *same* is an adjective, not an NP! As a consequence, NPs that contains *same* do not denote generalized quantifiers either. Put another way, Keenan's result is only a show-stopper if we assume that the only kind of scope-taking expression is an NP. One of the main points of this paper, then, will be to argue that scope-taking is considerably more pervasive and more varied than usually considered.

3 The internal reading is not a special case of the deictic reading

Given that a deictic reading is always available for *same*, one obvious and important question is whether the internal reading could be adequately treated as a special case of a deictic reading. After all, pronouns standardly receive exactly this kind of analysis:

(8) a. Mary saw him_i.
b. Everyone_i thinks $\text{she}_{i,j}$ is intelligent.

On the traditional analysis, pronouns translate as variables. (8a) has only a deictic reading on which the pronoun translates as a variable that receives its value from context. (8b) has both a deictic and a quantificationally-bound reading (potentially analogous to an internal reading for *same*), depending on whether the pronoun translates as some independent variable (i.e., '*j*'), or translates as the same variable bound by the quantifier introduced by *everyone* (i.e., '*i*'). There is no difference in the analysis of the pronoun; the bound reading arises when the variable that serves as the translation of the pronoun happens to coincide with the index of some other element in the same sentence.

Perhaps, then, *same* introduces some variable, and the internal reading arises when that hypothetical variable is bound by some other element in the sentence. Let us imagine what such an analysis would be like.

(9) Two women in this room have the same name.

On the deictic reading, the speaker may have a specific name in mind, as when (9) is used in the following monologue: "My friend Heddy's name is highly unusual; nevertheless, two women in this room have the same name." In such a context, (9) will be true only if there are two women in the room whose name is *Heddy*.

On the internal reading, in contrast, (9) will be true just in case there is any name such that two women in the room have that name. To emphasize the quantificational nature of these truth conditions, note that a speaker might assert (9) on the basis of a mistaken belief that there are two women in the room named *Heddy*. But if, unbeknownst to the speaker, there are two women named *Mary* in the room, the sentence is nevertheless true, albeit accidentally.

In view of these observations, it seems inescapable that on the internal reading, some element in the sentence must in effect introduce an existential quantifier over names. Nor can we pin the existential force on the cardinal *two*:

(10) Everyone read the same book.

In addition to the deictic reading (on which we have a specific book in mind, say, *Emma*), (10) has an internal reading on which it is true if there is any book such that everyone read that book.

In unpublished work, Dowty (1985) proposes an analysis of *same* that explicitly attempts to reduce the internal reading to a special case of the deictic reading. On Dowty's proposal, in addition to introducing existential quantification, the denotation of *same* also introduces two contextually-determined variables, C and R.

(11) $[\![same]\!] = \lambda N.\lambda x \exists f : \{x\} = f(N) \wedge \forall c < C : Rxc$ [Dowty]

Here, C is a contextually-specified set of individuals that Dowty calls a comparison class. In the case of (10), C will be assigned by the context to the set of individuals quantified over by *everyone*. The relation R is a contextually-specified relation over individuals, the relation that holds between each member of the comparison class and the object x that the predicate *same book* picks out. In (10), R will be $[\![read]\!]$, so (10) will assert that there is some book x such that everyone read x.[1]

Beck (2000) proposes an analysis for *different* that also crucially relies on a contextually-supplied comparison set (though it is not clear whether her analysis generalizes to *same*). Analogously to Beck's discussion of *different*, there is a parallel between the uses of *same* here with uses that have an overt *as* phrases (e.g., *the same book as everyone else read*), which arguably motivates reference to a comparison class and a comparison relation.

Bearing in mind that one of Dowty's goals is to unify the deictic and the internal readings, certainly there will always be a choices for C and R that result in appropriate truth conditions for the deictic reading. Dowty provides an example involving *different* motivating the claim that the values of R and C can be determined from outside the sentence (i.e., deictically):

(12) The teachers discussed *Taxi Driver*, but the students saw a different movie.

If we choose $C =$ the teachers and $R =$ discussed, we get appropriate truth conditions for (12): each student saw a movie that is different from a discussed movie.

However, it is not clear that there is ever a situation in which a deictic use is able to exploit the full truth-conditional power provided by access to a comparison set.

(13) The men discussed a house. John read the same book.

If we could choose C as the set of men and R as the relation **discussed**, (13) would assert that there exists a book such that each of the men discussed that book, and that is the book that John read. But there is no such reading; nor is there even a reading on which John read the same book that each of the men read (i.e., choosing $C =$ the men and $R =$ read).

[1] I have taken some liberties in my presentation of Dowty's proposal in an order to facilitate comparison with my own proposal below. Most notably, the existential quantifier in (11) quantifies over adjective meanings, though Dowty's version quantifies over individuals (leading to equivalent truth conditions). In any case, I have (I hope) faithfully preserved the roles of C and R.

Now, the absence of logically possible readings can perhaps be explained on pragmatic grounds (though it is not obvious to me what such an explanation would look like in this case). But there seems to be a systematic pattern at work: whenever one of *C* or *R* takes its value from the same clause as *same*, the other does too.

(14) Anna and Bill read the same book.

If the comparison class *C* is the set consisting of Anna and Bill, then the relation *R* must be **read**.

Even more suspiciously, there seems to also be a systematic relation between the values of *R* and *C* for the internal case: on any internal reading, *R* always turns out to be the remainder of the clause after the NP giving rise to the comparison class *C* has been subtracted.

(15) Anna and Bill must have read the same book.

For instance, there is a reading of (15) on which *C* is the set consisting of Anna and Bill and *R* is the remainder relation **must-have-read**; but there is no reading on which *C* is Anna and Bill but *R* is just **read** (in which case (15) would express a tautology).

What I'm suggesting, then, is that there is a systematic correlation between the choice of *C* and the choice of *R* that goes unexplained on the pragmatic account. As Carlson (1987:532) puts it, on the internal reading, "the comparison is somehow made available by virtue of the meaning of the sentence itself". We shall see that on the semantic account below, at least for the internal reading, the relation that serves the role of *R* systematically corresponds to what is left over after subtracting the NP corresponding to the comparison set. (Looking ahead to the formal treatment in Sect. 7, this remainder is a continuation.)

There are also some empirical difficulties for the unified analysis, at least in the version of the analysis given in (11).[2]

(16) a. The men or the women read the same book.
b. Ann read and Bill reviewed the same book.

In (16a), the truth conditions are clear: either the men read the same book, or else the women read the same book. Yet there is no choice for *C* that gives the correct truth conditions.

Similarly, for the right node raising example in (16b), there is no suitable choice for *R*. In particular, we can't chose the complex relation of reading-or-reviewing, since there would be no way of guaranteeing that

[2] Dowty's paper, though highly insightful, remains unpublished in draft form; a more developed analysis might very well have anticipated examples like those discussed here.

what Ann did to the book was read it, or that what Bill did to the book was review it.

In any case, I will take the discussion in this section as motivating at least considering a semantic (combinatoric) treatment.

4 Distributivity, events, and NP-internal *same*

Carlson (1987) makes a strong case that the availability of an internal reading depends on distributing over events:

(17) John read the same book.

In (17), there is just a single reading event, and only a deictic reading is possible.

(18)	a.	John and Bill read the same book.	Conj. NPs
	b.	The men read the same book.	Plural NP
	c.	John hit and killed the same man.	Conj. Vs
	d.	John read the same book yesterday and today.	Conj. Adv.
	e.	John read the same book quickly and slowly.	Conj. Adv.

In (18), in contrast, internal readings are also available—but only when the sentence describes multiple events. In (18a), for instance, if John and Bill read the book collaboratively, the internal reading disappears. Similarly for (18b), the men in question must each participate in a separate reading event. In (18c), in order for an internal reading to be available, the hitting and the killing must be separate events (i.e., the blow was not in and of itself fatal; to see this, consider the impossibility of an internal reading for *John hit and thereby killed the same man*.) In (18d), if John read slowly and continuously for 48 h, the internal reading disappears; and finally, in (18e), *quickly* and *slowly* cannot describe the manner in which John read different chapters—rather, they must describe the manner in which John performed separate readings of the book.

One of the most interesting aspects of *same* is the variety of triggers for the internal reading: in (18), we have coordinated NPs, other types of plural NP, coordinated verbs, coordinated adjuncts, and coordinated adverbs. Singular quantificational NPs are also capable of triggering an internal reading:

(19) a. Everyone read the same book.
b. No one read the same book.
c. John read the same book every quarter.
d. John read the same book twice.

As (19d) shows, even a quantificational adverb can trigger an internal reading.

It appears to be a sufficient condition for the availability of an internal reading that some element in the sentence—any element—entails the existence of multiple events. Oehrle (1996) exploits this idea to provide an account of *same* and *different* based on the interaction of events and individuals.

Yet event multiplication (as Tovena and Van Peteghem (2002) call it) is not a necessary condition for the internal reading.

(20) [Two men with the same name] are sitting in this room.

Although never before noted in the literature (as far as I know), NP-internal uses of *same* as in (20) also clearly can have an internal reading. On the deictic interpretation, (20) makes a claim about the prevalence of some specific name; on the internal reading, (20) will be true if there is any name such that two men sitting in the room share that name, whether the speaker is aware of what that name might be or not.

If we want to claim that the internal reading requires multiple events, then we must decide that having a name must qualify as an event. I will assume instead that what the internal reading requires is multiple situations. Distinct events certainly count as distinct situations, but configurations of objects described by non-verbal relations can also serve as distinct situations.

5 Why nominal scope is natural for *same*

The general strategy I will take in the remainder of the paper is to begin by analyzing the NP-internal use of *same*. This will give us a basic syntactic and semantic analysis. Then I will extend the analysis to more familiar examples. In each case, the adjustments are fairly minor. NP-internal *same*, then, tells us almost everything we need to know about *same*.

In this section, I show that—given LIFT as a basic type-shifting operation—we can predict the possibility of adjectives behaving the way that *same* behaves. In other words, I claim that it is natural for adjectives to take scope. Furthermore, I claim that when they do, it is natural for them to take scope over nominals.

5.1 NP-internal *same* is essentially quantificational

The truth conditions for the internal reading entail that the meaning of *same* must be essentially quantificational, since (20) will be true if there is any suitable name. (This is the same conclusion we came to in Sect. 3 with respect to other uses of *same*.) A paraphrase of the internal reading of (20), then, might be

(21) $\exists f_{\texttt{choice}}$. two men with the f name are sitting in this room.

This paraphrase quantifies over adjective meanings (type $\langle\langle \texttt{e},\texttt{t}\rangle,\langle \texttt{e},\texttt{t}\rangle\rangle$). But not just any adjective meaning will do; *same* insists on a value that is, in effect, a choice function, in the following sense: given any set of entities X, it will return a singleton set chosen from X. Thus (20) will be true only if there is some choice function f that picks out (a singleton set containing) a specific name (for instance, $f(\textbf{name})$ might be $\{Ed\}$) such that two men sitting in the room have that name.

As discussed in Sect. 3, a sentence like (20) can be true accidentally, as long as there exists some name possessed by two men in the room. I take this truth-conditional sensitivity to mere existence as the hallmark of existential quantification. Therefore I will assume that the semantics of *same* must contribute some kind of existential quantification.

Given that there is existential quantification involved, we must try to determine where that existential quantifier can take scope.

(22) [John met two [men with the same name]]
↑ ↑
not here here

For the example in (22), either of the scope possibilities indicated will do. But if *two* is replaced with a determiner that is downward monotonic on its first argument, then allowing the existential to take wide scope gives inappropriately weak truth conditions:

(23) a. John met fewer than three men with the same name.
b. $\exists f$. John met fewer than three men with the f name.

The paraphrase in (23b) will be true if there is any name such that John has met fewer than three men with that name. But those truth conditions are too weak for any reading of (23a): in particular, the internal reading of (23a) should never be true merely because John has met only two people named *Orville* during his life. (There will of course also be a deictic interpretation of (23a). Perhaps we've just been trading remarkable facts about the name *Orville*, and I utter (23a). But we're interested in the sentence-internal reading here.)

Choice functions are often used in linguistic analyses in order to allow indefinites to behave as if they had wide scope without actually giving them wide scope (i.e., without actually allowing them to undergo extra-long Quantifier Raising). But I will propose here that *same* takes scope in a completely normal manner (despite the fact that *same* is not an NP). The reason I am using a choice function, then, is not to achieve unusual scope, but out of respect for the syntactic category of *same*: since adjectives map predicates to predicates, the variable corresponding to *same* will likewise maps predicates to (in this case, singleton) predicates.

In any case, I will assume that the existential quantifier introduced by *same* can take scope at the level of the nominal. There are other logical possibilities for the scoping of the existential introduced by *same* besides the nominal position, of course. For instance, a referee suggests that it might be possible for *same* to scope at the modifier level, i.e., over *with the __ name*, which might simplify the semantic analysis in some respects. However, we shall see immediately below that other considerations converge on the nominal as the natural place for the existential to take scope.[3]

5.2 Anatomy of a quantifier

Moortgat (1997) generalizes over scope-taking expressions by providing a category constructor *q* ('*q*' for *q*uantificational) that builds a scope-taking category by combining three elements: a local syntactic Personality, a scope Target, and a final Result category. The category of *everyone*, for instance, is *q*(NP,S,S): locally, *everyone* behaves as an NP, takes scope over a clause of category S, and produces as a result another clause.

The semantic type of a scope-taking expression *q*(P, T, R) is $\langle\langle P', T'\rangle, R'\rangle$, where P', T', and R' are the types of categories P, T, and R, respectively. Assuming that the natural basic semantic type of a non-quantificational NP such as *John* is $\mathtt{e}$ (the type of an individual), and that the (extensional) type of a clause is $\mathtt{t}$ (the type of a truth-value), then *everyone* will have semantic type $\langle\langle \mathtt{e}, \mathtt{t}\rangle, \mathtt{t}\rangle$—naturally, the type of a generalized quantifier.

For most scope-taking expressions, the target category and the result category are the same (schematically, *q*(P, X, X)), though not always. For instance, in-situ wh-phrases might reasonably be analyzed as having category *q*(NP, S, Q): something that functions locally as an NP, takes scope over a clause, and turns that clause into a question.

I have suggested above that *same* is a scope-taking element that functions locally as an adjective and takes scope over a nominal. Assuming that the result category is the same as the scope target, we can anticipate that the category that we will arrive at below for *same* will be *q*(Adj, N, N).

The formal system in Sect. 7 will give a Type Logical grammar that factors *q* into two complementary (residuated) type-forming connectives along lines suggested in the next few subsections.

5.3 An indispensable type-shifting operator: LIFT

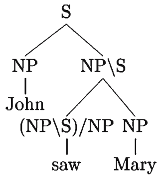
Most grammatical systems that allow any type-shifting at all provide a shifting operation identical to or closely related to an operator that I will call LIFT, including Partee and Rooth (1983), Partee (1987), Hendriks (1993), Jacobson (1999), Steedman (2000), and many others.

I will take for basic category labels NP, S, and N (where N is the category of nominals such as *men*). In order for syntactic categories to record the effect of type-shifting, in addition to the basic categories, we will need structured syntactic categories. Therefore we will also have categories of the form A\B and

[3] If we take the modifier phrase to denote a simple predicate (semantic type $\langle \mathtt{e}, \mathtt{t}\rangle$) rather than a modifier $\langle\langle \mathtt{e}, \mathtt{t}\rangle, \langle \mathtt{e}, \mathtt{t}\rangle\rangle$, it would be easy to generalize the analysis below to allow *same* to take scope at the modifier level as well as at the nominal level. This would require adopting some version of Heim and Kratzer's (1998) Predicate Modification composition rule. If there were empirical evidence showing that *same* could or must take scope over the modifier only, that could be interpreted as an argument in favor of a Predicate Modification analysis of nominal modifiers.

B/A, where A and B are categories. Then the categories of verbs and verb phrases can be built up from the basic categories as follows:

(24)



As in Lambek (1958), slashes lean in the direction of the expected argument: *saw* expects an NP on its right to form a verb phrase of category NP\S, which in turn expects an NP to its left to form an S. Categories of the form B/A and A\B have semantic type $\langle A', B' \rangle$.

LIFT says that any expression in category A will also be in category B/(A\B). LIFT is so basic and natural that in Lambek's (1958) grammar, and therefore all type-logical grammars based on Lambek's work, LIFT doesn't even need to be stipulated, since it is a theorem of the logical system. For instance, in the sequent logic given below in Sect. 7, we have the following proof:

$$\dfrac{\dfrac{\Gamma \vdash A \qquad B \vdash B}{\Gamma \bullet A \backslash B \vdash B}\backslash L}{\Gamma \vdash B/(A \backslash B)}/R$$

In particular, if the proper name *John* is in the category NP, then *John* is automatically also in the category S/(NP\S) by virtue of LIFT.

Note that the derived category S/(NP\S) has semantic type $\langle\langle \mathtt{e}, \mathtt{t}\rangle, \mathtt{t}\rangle$, the semantic type of a generalized quantifier. In other words, the LIFT operation characterizes, among other things, the relationship between individual-denoting NPs like *John* and their generalized-quantifier counterparts. Furthermore, the Curry-Howard labeling of the proof just given tells us that the denotation of the generalized quantifier version of *John* will be $\lambda P.P\mathbf{j}$, where $\mathbf{j}$ is the individual denoted by *John*, which is exactly the right meaning for the generalized quantifier version of *John* to have.

What this suggests is that we can approximate Moortgat's q operator using slashed categories: an expression with category q(P, T, R), then, corresponds to the slashed category R/(P\T).[4]

In this instance, then, LIFT turns an expression with no scope-taking ability into a quantificational expression. Analogously, I will show how judicious

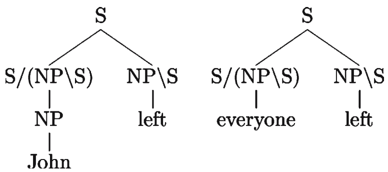
[4] In Sect. 7, it will be necessary to distinguish between normal slashes, such as the slash in NP\S that governs the linear order of arguments, versus quantificational slashes. In the more detailed system in Sect. 7, q(P, T, R) will be rendered as R⫽(P⑊T), where ⑊ and ⫽ constitute a mode of combination that is parallel to but distinct from / and \. But it will significantly simplify discussion here to collapse the both modes onto / and \.

application of LIFT will turn a normal (non scope-taking) adjective into a scope-taking adjective suitable to serve as the category of *same*.

One way of putting it is that the LIFT operation makes *John* aware of its surroundings. We can gloss the category of a verb phrase NP\S as saying "I need an NP to my left in order to be a complete S". Then the gloss on the category of the LIFTed version of *John*, S/(NP\S), is "I need something that needs me."

Although LIFT enables every NP to take on the semantic type of a generalized quantifier, only some NPs have meanings that take advantage of the additional expressive range available to the generalized quantifier type. For instance, *everyone* has a meaning that is essentially quantificational, and therefore can only be expressed by a generalized quantifier. This means that *everyone*'s most basic category is S/(NP\S), i.e., a category that looks like a lifted non-quantificational NP.

(25)

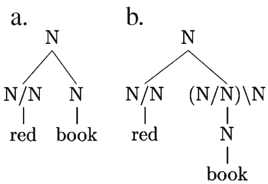


In general, then, scope-taking expressions live at the level of a LIFTed non-scope-taking expression.

As mentioned above, our goal is to arrive at a category for *same* of N/(Adj\N): locally, an adjective, taking scope at a nominal, and producing a nominal as a result. We'll get there the same way we arrived at a generalized quantifier from a non-quantificational NP, i.e., by LIFTing; except that in this case, we'll need to lift twice.

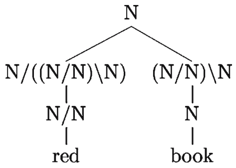
First, we can implement the category Adj as an expression that expects a nominal N to its right to form a complex nominal:

(26)



In our anthropomorphic interpretation, the adjective *red* is the kind of expression that needs an N, and the basic nominal *book* in (26a) satisfies that need. After we lift *book*, as in (26b), the adjective is still seeking an N, but the nominal has had its consciousness raised, so that now it is seeking something that seeks a nominal: "I need something that needs me."

(27)



Now we can lift the adjective, so that it says "I need something that needs me to need it".

At this point, we have the category we are seeking, which is $q(\mathrm{N/N, N, N}) = \mathrm{N/((N/N)\backslash N)}$: locally, an adjective, taking scope over a nominal.

Two observations: although we have arrived at this point in steps via two applications of LIFT, the relationship between the basic Adjective category N/N and the scope-taking category N/((N/N)\N) is characterized by a single application of LIFT. Second, the Curry-Howard labeling of the LIFTing operation provides a denotation for the lifted adjective that parallels the generalized quantifier denotation of a proper name: $\lambda P.P\,\mathbf{red}$, where **red** is the basic (i.e., category N/N) meaning of *red*.

Just as a quantificational NP such as *everyone* has the category of a LIFTed non-quantificational NP such as *John*, a scope-taking adjective such as *same* has the category of a LIFTed normal adjective like *red*.

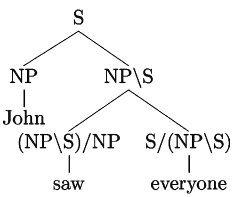
5.4 From type clash to Quantifier Raising, Heim and Kratzer style

Now that we have a quantificational category, we need to provide a mechanism that will allow it to take scope. I will develop my initial discussion of scope in the style of Heim and Kratzer's (1998) textbook for several reasons, not least of all because it is simple, well motivated, and familiar to most readers.

In addition, Heim and Kratzer's specific implementation of quantifier raising has one unusual detail that will turn out to be convenient for our purposes. Eventually, however, I will replace Quantifier Raising in Sect. 7 with a continuation-based type-logical grammar in which LIFT is a theorem.

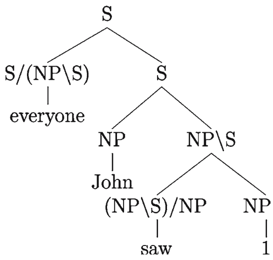
Heim and Kratzer motivate Quantifier Raising as a strategy to repair type clash. As we saw in (25), a quantificational or lifted NP can occur in subject position without any problem, since a verb phrase is exactly the right sort of object to satisfy the needs of the lifted NP. But when generalized quantifier NPs occur in non-subject positions, type clash can occur.

(28)



That is, *saw* expects a simple NP to its right, but finds instead a generalized quantifier. Since plain LIFT will not help here, we need some other way. Quantifier Raising is the standard technique to resolve this type clash. The basic idea is to raise the generalized quantifier to adjoin to its scope target, replacing the raised quantifier with a variable over simple NP denotations (as Heim and Kratzer have it, in this case the variable will be a numeral, here, 1).

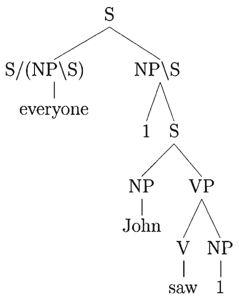
(29)



This resolves the type clash at the level of the transitive verb, since now the verb finds just the type of argument it was hoping for (i.e., NP).

Unfortunately, Quantifier Raising resolves type clash lower down only to recreate it higher up. At the adjunction site, the generalized quantifier expects an argument of category NP\S, but finds instead an expression of category S. Interestingly, Heim and Kratzer propose a slightly different version of Quantifier Raising that introduces an intermediate node in between the scope target and the result category[5]:

(30)



Following Heim and Kratzer, we can articulate the raising operation into the following steps:

(31)(i) Replace the scope-taking expression with a variable.
(ii) Adjoin the scope-taking expression to its scope target.
(iii) Adjoin a second occurrence of the variable inserted in step (i) to the scope target.

[5] I will sometimes use VP as an abbreviation of NP\S, and V as an abbreviation for (NP\S)/NP to keep the trees a little bit simpler.

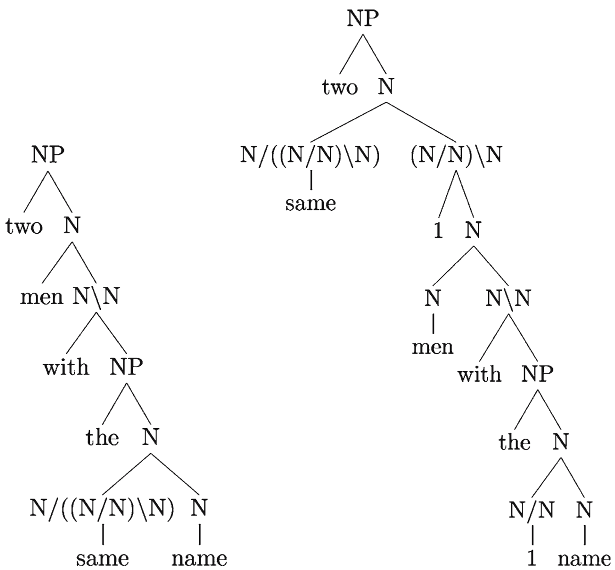
Even these steps do not alleviate all type clashes, since step (iii) creates a subtree with an index (interpreted as a variable) of type e as sister to an S node of type t: neither one has a type appropriate to serve as a function on the other. Therefore, as Heim and Kratzer explain, the node inserted in step (iii) receives a special interpretation: this constituent translates as a lambda abstract with the index serving as the distinguished variable. (To visualize the interpretation of the constituent in question, just draw a λ to the left of the uppermost occurrence of the variable.)

In any case, what is most important for present purposes is that the interpretation of the node inserted in step (iii) will have just the right semantic type to serve as an argument of the scope-taking expression. The importance of this extra node is that it will play a crucial role in the discussion of parasitic scope in Sect. 6. Heim and Kratzer do not provide their intermediate node with a category label, so we are free to assign it to category NP\S, since that is the category that the generalized quantifier to its left is looking for (and has the appropriate semantic type).

In general, the raising algorithm will produce analogous results for any scope-taking category *q*(P,T,R): after inserting a variable, raising, and abstracting, the node inserted in step (iii) will have semantic type $\langle P', T' \rangle$, which is just the right sort of object to serve as the argument to the denotation of the scope-taking element (whose semantic type, recall, is $\langle\langle P', T' \rangle, R' \rangle$).

In particular, since our LIFTed adjective has category *q*(Adj, N, N) = N/(Adj\N), it functions locally as an adjective, takes scope over a nominal, and returns a nominal as a result:

(32)



On the left, before Quantifier Raising, there is type clash at the level of the adjective. On the right, after Quantifier Raising, the adjective has found its scope.

Thus giving *same* a LIFTed category automatically predicts that it can take scope over a nominal.

5.5 Denotation for *same*.

If we LIFTed and raised a typical intersective adjective such as *long*, the semantics of lifting in combination with the semantics of raising cancel out, in the same way that Quantifier Raising a LIFTed proper name makes no detectable semantic difference. It is only when the meaning of the NP in question is essentially quantificational (e.g., *everyone*) that Quantifier Raising makes a detectable difference. Just so, raising an adjective only makes a detectable difference if the adjective's meaning is essentially quantificational.

I am proposing, of course, that *same* is just such an adjective:

(33)a. $\text{type}(\textit{same}) = \text{type}(q(\text{Adj},\text{N},\text{N})) = \langle\langle Adj', N'\rangle, N'\rangle$

b. $[\![\textit{same}]\!] = \lambda F_{\langle \text{Adj},\text{N}\rangle}\lambda X_{\mathtt{e}}.\exists f_{\mathtt{choice}}\forall x < X : Ffx$

Here F is a variable over objects of type $\langle$Adj, N$\rangle$, the type of a function from adjective meanings to nominal meanings, i.e., semantic type $\langle\langle\langle \mathtt{e},\mathtt{t}\rangle, \langle \mathtt{e},\mathtt{t}\rangle\rangle, \langle \mathtt{e},\mathtt{t}\rangle\rangle$. In addition, f is a variable over choice functions of type $\langle\langle \mathtt{e},\mathtt{t}\rangle, \langle \mathtt{e},\mathtt{t}\rangle\rangle$. Usually, choice functions are given type $\langle\langle \mathtt{e},\mathtt{t}\rangle, \mathtt{e}\rangle$, but as explained above in Sect. 5.1, we need a function that will deliver a result that is suitable to combine with a determiner; therefore a choice function here will be a nominal modifier that takes (the characteristic function of) a set of individuals and returns a singleton set whose unique member is chosen from the original set. For instance, if *name* denotes a property that is true of the names *Anna, Bill*, and *Cam*, then $f([\![\textit{name}]\!])$ might be the property that is true only of the name *Bill*. Finally, I will use capital X as a variable over non-atomic entities. For example, if $X = [\![\textit{Anna and Bill}]\!] = \mathbf{a} \oplus \mathbf{b}$ in the usual way, then $\mathbf{a} < X$ and $\mathbf{b} < X$, where $<$ is the proper-part relation over the count domain.

Inserting the denotation in (33b) into the analysis in (32), we have:

(34)a. $[\![\textit{two men with the same name}]\!] =$

b. $\mathbf{two}(\lambda X.\exists f \forall x < X : [\mathbf{with}(\mathbf{the}(f(\mathbf{name})))\,(\mathbf{men})]\,(x))$

c. Objects X with cardinality 2 such that

there is a choice function f such that

each proper subpart of X has f(name).

d. I.e.: pairs of men where both members have the same name

Then a sentence such as *Two men with the same name left* can be paraphrased as follows: there is a pair of men and a name such that both members of the pair have that name, and that pair of men left.

This analysis builds the distributivity that Carlson (1987) argues characterizes the internal use of *same* directly into its lexical meaning. Unlike Carlson, however, there is no direct reference to events or sets of events. This is a good thing, of course, in view of NP-internal examples such as (34)!

5.6 Why *same* is obliged to take non-trivial scope

The analysis here says that *same* needs to take scope at some dominating nominal. But I have assumed that an adjective is a nominal modifier, i.e., has category N/N. That means that in an NP such as *two men with the same name*, there are two nodes labeled N that dominate *same*: *men with the same name*, and *same name*, the nominal complement of *the*, as illustrated in (32).

But if the N node corresponding to *same name* were a legitimate scope target for *same*, we would expect **two same men left* to be grammatical with an internal reading.

What, then, prevents *same* from adjoining to its mother? The answer I will offer is that nothing prevents this from the point of view of scope-taking; but because of details of the denotation of *same*, the meaning that results is guaranteed to be true of no object, and hence will be useless. More specifically, the property denoted by *same men* would be true of a non-atomic entity X just in case there is some choice function f and every proper subpart of X is $f(\mathbf{men})$. For the sake of discussion, choose $X = [\![\mathit{Bill\ and\ Cam}]\!] = \mathbf{b} \oplus \mathbf{c}$. No matter what choice function we select as the value of f, we have $\{\mathbf{b}\} = \mathbf{f}(\mathbf{men})$ and $\{\mathbf{c}\} = \mathbf{f}(\mathbf{men})$. But since f is a choice function, it follows that $\mathbf{b} = \mathbf{c}$, contrary to the entailment that X is non-atomic, i.e., has distinct atomic parts. By analogous reasoning, there is no suitable choice for X, and the property is semantically guaranteed to denote the empty property in all situations.

Interestingly, a referee points out that the ban on trivial scope for *same* is somewhat relaxed in German:

(35) zwei gleiche Socken
two same socks
'two matching socks'

However, this construction can only be used when the socks in question are type-identical, not when they are token identical. For whatever reason, English has generalized the incoherence of counting a single object as a plurality to all cases of trivial scope.

Furthermore, even in English there are other quantificational adjectives that are perfectly happy taking trivial scope.

(36) a. two men with different names
b. two different men

For instance, in addition to the quantificational internal reading of (36a), in which *different* takes scope over the nominal *men with _ names*, in (36b), *different* takes trivial scope over only *men*. (I suspect that this is what Carlson (1987) calls the 'various' reading of *different*.)

It might seem that *two different men* means the same thing as *two men*, and we've swung from a contradictory description with *same* to a semantically redundant modification with *different*; but as noted in Barker (1998), there are situations in which trivial-scope *different* has a non-trivial semantic effect:

(37) a. 4,000 ships passed through the lock last year. [Krifka]
b. 4,000 different ships passed through the lock last year.

As Krifka (1990a) observes, (37a) can be true if 2,000 distinct ships passed through the lock twice each, in which case what we have 4,000 of are ship stages. In (37b), the addition of *different* renders the stage-based interpretation unavailable: there must be at least 4,000 distinct ships. The ships must be different at the level of the individual, and two stages of the same ship do not count as different.

For an example of a quantificational adjective even closer to *same*, consider *similar*, which clearly has a quantificational interpretation as in *Two men with similar names left* (by an argument closely analogous to the discussion of *same* above). But *similar* also has a use with trivial scope, as in *Two similar men left*. The relevant difference between *same* and *similar* is that two distinct atomic entities can fall within the (vague) tolerance of counting as sufficiently similar, without counting as the same.

5.7 A definiteness puzzle

Why does *same* require the definite determiner? That is, why does English insist on *the same name* rather than ***a** same name*? Even more peculiar, definite descriptions involving *same* do not trigger existence presuppositions the way that typical definite descriptions do.

(38) a. John and Bill read the long book.
b. John and Bill didn't read the long book.
c. Did John and Bill read the long book?
d. John and Bill might have read the long book.

In (38a), a use of the definite description *the long book* presupposes the existence of a long book. Thus whether the sentence is negated (38b), questioned (38c), or embedded beneath an epistemic modal (38d), the implication remains that a (unique) long book exists.

(39) a. John and Bill read the same book.
b. John and Bill didn't read the same book.
c. Did John and Bill read the same book?
d. John and Bill might have read the same book.

But if the non-quantificational adjective *long* is replaced with *same*, the presupposition disappears: whether or not there is a (unique) book that John and Bill each read is precisely what is at issue in (39a), so if the sentence is negated, questioned, or embedded under an epistemic modal, there is no guarantee that such a book exists.

The quantificational analysis can provide some insight, at least at a functional level. Consider once again the proposed denotation for *two men with the same name*:

(40) $\mathbf{two}(\lambda X.\exists f \forall x < X : [\mathbf{with}(\mathbf{the}(f(\mathbf{name})))\,(\mathbf{men})]\,(x))$

Since f is a choice function, $f(\mathbf{name})$ is semantically guaranteed to denote a property that is true of a unique name. It makes a certain amount of sense that when a nominal is semantically guaranteed to denote a singleton set that the determiner would be *the* rather than *a*; but even if so, it remains a mystery why the presupposed part of the existence implication normally associated with a use of the definite determiner is suspended in the case of *same*.

6 Parasitic scope

This section shows how the analysis for the NP-internal use easily accounts for more standard examples such as *Everyone read the same book*. The key insight is that, when raising an NP, the extra node inserted by Heim and Kratzer-style Quantifier Raising has the same semantic type as a nominal, namely, $\langle \mathtt{e}, \mathtt{t} \rangle$. I will exploit this fact by allowing *same* to take the extra node as its scope target.

In order to make this idea work, we need to identify the category N with the category NP\S. But we chose N arbitrarily as a basic syntactic category, so nothing prevents us from choosing N = NP\S.[6]

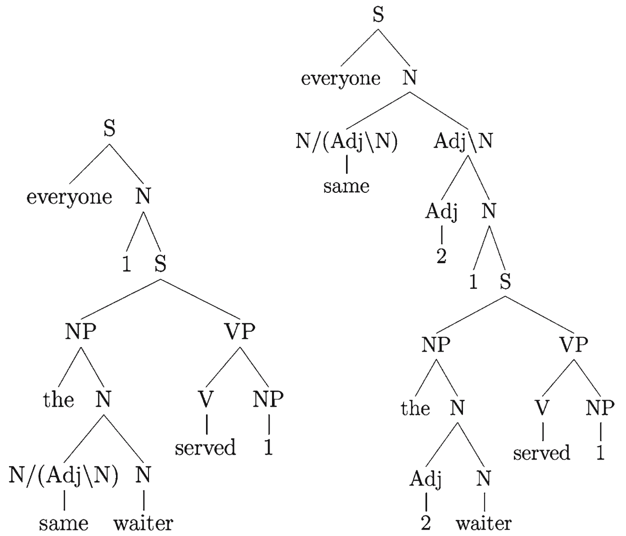
Once we agree that N is an abbreviation for NP\S, parasitic scope falls out[7]:

(41) The same waiter served everyone. [Stump; Heim]

[6] Ultimately, it will be necessary to distinguish syntactically between nominals (category N),verb phrases (NP\S), and the node inserted during Quantifier Raising (currently, also NP\S). The analysis in Sect. 7 will make these distinctions; nevertheless, it is not misleading to collapse those distinctions here for the sake of exposition, since the final analysis in Sect. 7 will still arrive a single lexical entry for *same* that simultaneously covers NP-internal examples as well as the examples discussed in this section.

[7] The key example developed in this section will be a type of sentence attributed to Heim in Dowty (1985). Similar examples appear in Stump (1982) without discussion. One point of interest with respect to this sentence is that the trigger (*everyone*) is asymmetrically c-commanded by the NP containing *same*. This is one type of example that makes it more difficult to attempt to reduce the behavior of *same* or *different* to reflexives or anaphors such as *each other* (see Beck (2000) for an instance of this type of analysis for *different*).

Parasitic Scope:



In the tree on the left, *everyone* has already taken scope, creating an intermediate node labelled N. This newly-created node then serves as the scope target for *same*, which then raises to yield the tree on the right.

The reason I call this parasitic scope is that the scope target for *same* does not even exist until *everyone* has taken scope. The adjective then hijacks the scope of *everyone*, intervening between the quantifier and what would otherwise be its semantic argument.

Sauerland (1998, Sect. 3) also (independently, as it happens) proposes something closely similar to parasitic scope, which he calls 'binary predicate formation via movement'. On his analysis of certain distributivity patterns, NPs can take scope between a raised quantifier and its nuclear scope. This creates rather than resolves type-clashes, of course, which are eventually resolved by a polymorphic distributivity type-shifter.

Because the semantic argument of the generalized quantifier is $\langle \mathtt{e}, \mathtt{t} \rangle$, the same type as a nominal, we can use the same denotation for *same* proposed above in (33b). More specifically, we have:

(42)a. The same waiter served everyone.

b. $\mathbf{everyone}(\lambda X.\exists f \forall x < X : \mathbf{served}(x)(\mathbf{the}(f(\mathbf{waiter}))))$

c. Everyone collectively has the property of being a group such that there is a unique waiter who served each member of the group.

This analysis assumes that *everyone* denotes a generalized quantifier that can take a property of non-atomic entities as its argument. This somewhat problematic assumption is discussed in some detail in Sect. 6.2; but first, I'll show

how the same analysis accounts for plural NP triggers without any further stipulation.

6.1 Plural triggers

Plural NPs are the prototypical triggers for licensing an internal reading for *same* or *different*:

(43) a. The men read the same book.
b. John and Bill read the same book.

Here is how the assumptions defended so far account for examples like (43): obviously, plural NPs like *John and Bill* and *the men* are NPs. Therefore they can undergo LIFT just like a proper name such as *John*. In some theories, such as Partee and Rooth (1983), they not only can but must undergo LIFT in order to coordinate with generalized quantifiers, as in *every woman and the men*. Unlike Partee and Rooth, but like, e.g., Jacobson (1999), I will assume that LIFT applies freely, without constraint.

The net result is that plural NPs are always members of the quantificational category S/(NP\S), and therefore can freely undergo Quantifier Raising. Normally, Quantifier Raising an individual-denoting expression has no effect on the final result. But here raising a plural NP does make a detectable difference, since it provides a target for *same* to take scope at.

Thus we automatically predict that, for instance, (43b) has an internal reading that entails that there is a unique book such that proper subparts of the non-atomic entity consisting of John and Bill each read that book, as desired.

Nothing in the reasoning just given was specific to plural NPs. We might expect, then, that the same derivation applies to singular NPs; and in fact, it does:

(44) a. John read the same book.
b. $\mathbf{John}(\lambda X.\exists f \forall x < X.\mathbf{read}(\mathbf{the}(f(\mathbf{book})))(x))$

Like any NP, *John* can LIFT, undergo Quantifier Raising, and serve as a scope host to parasitic *same*. But the resulting interpretation is incoherent: it entails that there is a book such that each of the proper subparts of John read that book. Since $<$ gives dominance in the count domain (not the mass domain), John has no suitable proper subparts. The explanation for why (4a) does not have an discernible internal reading, then, is that there are no subparts for the distributivity that is built into the denotation of *same* to quantify over.

6.2 A puzzle for forging a formal link: *each*

As mentioned above, although the semantics of *same* comport beautifully with fairly standard assumptions about the denotations of plural NPs, they require some less standard assumptions about the denotations of generalized quantifiers like *everyone* and *each person*.

The problem is that because *same* is inherently distributive, it returns a property that is true only of non-atomic entities. But quantifiers like *everyone* are usually assumed to quantify over atomic individuals.

Fortunately for the analysis here, the quantifiers in question for the most part are also compatible with other collective predicates.

(45) a. #John gathered in the living room.
b. Everyone gathered in the living room.
c. No one gathered in the living room.

The truth conditions of (45b) require that there is a non-atomic entity *X* such that every relevant person is a part of *X* and *X* has the property of gathering in the living room. But these are exactly the truth conditions we were wishing for *same*. I will assume (perhaps over-optimistically) that any analysis that will provide the right truth conditions for (45b) will automatically explain the corresponding problematic example involving *same*.

Unfortunately, any explanation for (45b) is unlikely to extend to examples involving *each*.

(46) a. *Each person gathered in the living room.
b. The men (*each) gathered in the living room.

Unlike *everyone*, *each person* does not accept a predicate that is true only of non-atomic entities, whether *each* appears in determiner position as in (46a), or floated as in (46b). Apparently, *each* truly does insist on quantification over atomic entities.

(47) a. Each student follows the same core curriculum.
b. In a cooperative approach to the sponge activity, you can furnish each student with the same tessellating shape.
c. The students each read the same book.

It is all the more surprising, then, that determiner *each* seems to be compatible with a internal reading with *same* as in (47a) and (47b), though the internal reading seems somewhat degraded with floated *each* as in (47c).

I will sketch a tentative solution here for the problem posed by *each*. Intuitively, it is reasonably clear why (46a) is bad when (47a) is good: *each* in (46a) requires every member of the relevant set of individuals to have the property of gathering in the living room. Since single individuals cannot gather, (46a) is deviant. But *each* in (47a) requires that every relevant individual has the property of reading a certain book, and that is a property that the individuals involved do in fact have.

We can express the fact that the reading property goes all the way down to individuals by adding sensitivity to COVERS (in the sense of Schwarzschild (1996)) to the denotation for *same*. There is independent motivation for doing so:

(48) a. The men and the women gathered in different rooms.
b. The men gathered in different rooms.

(Similar examples can be constructed using *same*, but the truth conditions are clearer with *different*; see Sect. 8 below for a denotation for *different*.) There is a salient reading of (48a) on which the men gathered in one room, and the women gathered in some other room. Certainly it was not the individual men and women who were gathering; instead, the group consisting of all the men and all the women must be divided up somehow into subgroups. Given the conjunction, one salient division puts the men in one subgroup and the women in the other subgroup. Thus in (48), we must assume some way of dividing up the people into (non-atomic) subgroups before we can evaluate whether the sentence is true.

Following Schwarzschild, then, let **Cov**(X), a cover over X, be a set of parts of X such that every subpart of X is contained in one of the members of **Cov**(X). Then we can consider revising the denotation of *same* as follows:

(49) As in (33): $\lambda F \lambda X \exists f \forall x < X : Ffx$
New: $\lambda F \lambda X \exists f \forall x \in \mathbf{Cov}(X) : Ffx$

The only difference is that instead of quantifying over all the subparts of each group X, we quantify over only certain salient subparts of X, the subparts delivered by the **Cov** function. According to Schwarzschild and others, the **Cov** function is essentially pragmatic in nature, but is nevertheless sensitive to linguistic structure. For instance, the conjunction in (48a) makes the cover consisting of the men and the women highly salient.

All we need assume at this point is that *each*, whether floated or not, somehow forces an atomic cover.

The data in (48) make a compelling case that the distributivity built into scope-taking adjectives must be sensitive to covers, so the refinement in (49) is justified regardless of the treatment of *each*. However, sensitivity to covers does not play an important role in the remainder of the discussion, and I will revert to the original approximation in (48a) for the sake of expository simplicity.

As for *each*, what is left unexplained is how precisely the presence of *each* forces the selection of an atomic cover.

Beck (2000) contains many relevant observations and proposals concerning the selection of covers for examples involving *different*. Interestingly, she ultimately argues against using covers for examples involving *each*.

7 Continuations and the logic of parasitic scope

So far, I have relied on Heim-and-Kratzer-style Logical Forms to make clear what I have in mind for the composition of sentences involving *same*. This has the important advantage of being familiar to most semanticists, but it is also awkward in certain ways, most notably due to the need to graft on a category theory suitable for discussing LIFT. In this section I will provide a Type Logical Grammar in the tradition of Lambek (1958) as developed in Moortgat (1997) in which LIFT is a theorem, and in which scope-taking is handled directly by the logical machinery.

This grammar will explicitly recognize continuations as an essential part of scope-taking. Thus we need two modes of grammatical combination, namely /, \, the normal default mode familiar from all combinatory grammars; and ⫽, ⑊, the continuation mode. The grammar below, then, gives logical content to these symbols in a way that justifies their use in the previous sections of this paper.

The default mode is characterized by the following logical rules, as in Moortgat (1997:129).[8]

$$\frac{\Gamma \vdash A \qquad \Sigma[B] \vdash C}{\Sigma[(\Gamma \bullet A\backslash B)] \vdash C}\backslash L \qquad \frac{A \bullet \Gamma \vdash C}{\Gamma \vdash A\backslash C}\backslash R$$

$$\frac{\Gamma \vdash A \qquad \Sigma[B] \vdash C}{\Sigma[(B/A \bullet \Gamma)] \vdash C}/L \qquad \frac{\Gamma \bullet B \vdash C}{\Gamma \vdash C/B}/R$$

Given the axiom schema $A \vdash A$, we can derive a simple sentence as follows:

$$\frac{\dfrac{\text{NP} \vdash \text{NP} \qquad \text{S} \vdash \text{S}}{\text{NP} \bullet \text{NP}\backslash\text{S} \vdash \text{S}}\backslash L}{\textit{John} \bullet \textit{left} \vdash \text{S}}\text{LEX}$$

Assuming *John* has category NP, and *left* has category NP\S, this derivation proves that *John* concatenated with *left* forms an expression of type S.

The logical rules for the continuation mode are identical to those for the default mode up to substituting ⫽, ∘ and ⑊ for /, • and \:

$$\frac{\Gamma \vdash A \qquad \Sigma[B] \vdash C}{\Sigma[(\Gamma \circ A\backslash\!\!\backslash B)] \vdash C}\backslash\!\!\backslash L \qquad \frac{A \circ \Gamma \vdash C}{\Gamma \vdash A\backslash\!\!\backslash C}\backslash\!\!\backslash R$$

$$\frac{\Gamma \vdash A \qquad \Sigma[B] \vdash C}{\Sigma[(B/\!\!/A \circ \Gamma)] \vdash C}/\!\!/L \qquad \frac{\Gamma \circ B \vdash C}{\Gamma \vdash C/\!\!/B}/\!\!/R$$

The interaction between the default mode and the continuation mode is characterized by the following structural postulate, the only structural postulate in the system:

$$\frac{\Gamma[p]}{p \circ \lambda x \Gamma[x]}\lambda \quad \text{(double line)}$$

This is a somewhat unusual structural postulate. Here $\Gamma[p]$ is a structure containing a distinguished occurrence of the substructure p somewhere within it.

[8] For readability in the derivations, I indicate structural connectives by writing $A \bullet B$ instead of $(A, B)^{\bullet}$ and $A \circ B$ instead of $(A, B)^{\circ}$.

As usual, for any X, $\Gamma[X]$ is the structure that results from replacing the distinguished occurrence of p in Γ with X. Then $\lambda x\Gamma[x]$ is the structure just like Γ but with a variable in the place formerly occupied by the distinguished occurrence of p.[9]

For non-parasitic scope-taking, the postulate could be written using $\Gamma[\ ]$, the structure Γ with a hole in place of A; but this will not suffice for parasitic scope. The point of the "$\lambda x \ldots x \ldots$" decorations, then, is to keep track of which hole is which in structures that contain more than one hole. Therefore, for every application of the postulate in the top to bottom direction, the variable must be chosen 'fresh', i.e., distinct from all other variables in Γ.

Using the structural rule, we can continue the derivation above to derive a simple quantificational sentence with in-situ scope-taking:

$$
\begin{array}{cl}
\vdots & \\
\mathrm{NP} \bullet \mathrm{NP}\backslash\mathrm{S} \vdash \mathrm{S} & \\ \hline
\mathrm{NP} \circ \lambda x(x \bullet \mathrm{NP}\backslash\mathrm{S}) \vdash \mathrm{S} & \lambda \\ \hline
\lambda x(x \bullet \mathrm{NP}\backslash\mathrm{S}) \vdash \mathrm{NP}\backslash\!\!\backslash\mathrm{S} \qquad \mathrm{S} \vdash \mathrm{S} & \backslash\!\!\backslash R \\ \hline
\mathrm{S}/\!\!/(\mathrm{NP}\backslash\!\!\backslash\mathrm{S}) \circ \lambda x(x \bullet \mathrm{NP}\backslash\mathrm{S}) \vdash \mathrm{S} & /\!\!/ L \\ \hline
\mathrm{S}/\!\!/(\mathrm{NP}\backslash\!\!\backslash\mathrm{S}) \bullet \mathrm{NP}\backslash\mathrm{S} \vdash \mathrm{S} & \lambda \\ \hline
\textit{everyone} \bullet \textit{left} \vdash \mathrm{S} & \mathrm{LEX}
\end{array}
$$

Parasitic scope-taking will require recognizing the nuclear scope of some host quantifier as a constituent. This is achieved here by interleaving the $\backslash\!\!\backslash R$ and $/\!\!/ L$ inferences from a pair of scope-taking elements. A derivation of *Everyone read the same book* illustrates how this works:

$$
\begin{array}{cl}
\vdots & \\
\mathrm{NP} \bullet (\textit{read} \bullet (\textit{the} \bullet (\mathrm{N}/\mathrm{N} \bullet \textit{book}))) \vdash \mathrm{S} & \\ \hline
\mathrm{NP} \circ \lambda x(x \bullet (\textit{read} \bullet (\textit{the} \bullet (\mathrm{N}/\mathrm{N} \bullet \textit{book})))) \vdash \mathrm{S} & \lambda \\ \hline
\lambda x(x \bullet (\textit{read} \bullet (\textit{the} \bullet (\mathrm{N}/\mathrm{N} \bullet \textit{book})))) \vdash \mathrm{NP}\backslash\!\!\backslash\mathrm{S} & \backslash\!\!\backslash R \\ \hline
\mathrm{N}/\mathrm{N} \circ \lambda y\lambda x(x \bullet (\textit{read} \bullet (\textit{the} \bullet (y \bullet \textit{book})))) \vdash \mathrm{NP}\backslash\!\!\backslash\mathrm{S} & \lambda \\ \hline
\lambda y\lambda x(x \bullet (\textit{read} \bullet (\textit{the} \bullet (y \bullet \textit{book})))) \vdash (\mathrm{N}/\mathrm{N})\backslash\!\!\backslash(\mathrm{NP}\backslash\!\!\backslash\mathrm{S}) \qquad \mathrm{NP}\backslash\!\!\backslash\mathrm{S} \vdash \mathrm{NP}\backslash\!\!\backslash\mathrm{S} & \backslash\!\!\backslash R \\ \hline
(\mathrm{NP}\backslash\!\!\backslash\mathrm{S})/\!\!/((\mathrm{N}/\mathrm{N})\backslash\!\!\backslash(\mathrm{NP}\backslash\!\!\backslash\mathrm{S})) \circ \lambda y\lambda x(x \bullet (\textit{read} \bullet (\textit{the} \bullet (y \bullet \textit{book})))) \vdash \mathrm{NP}\backslash\!\!\backslash\mathrm{S} & /\!\!/ L \\ \hline
\lambda x(x \bullet (\textit{read} \bullet (\textit{the} \bullet ((\mathrm{NP}\backslash\!\!\backslash\mathrm{S})/\!\!/((\mathrm{N}/\mathrm{N})\backslash\!\!\backslash(\mathrm{NP}\backslash\!\!\backslash\mathrm{S})) \bullet \textit{book})))) \vdash \mathrm{NP}\backslash\!\!\backslash\mathrm{S} \qquad \mathrm{S} \vdash \mathrm{S} & \lambda \\ \hline
\mathrm{S}/\!\!/(\mathrm{NP}\backslash\!\!\backslash\mathrm{S}) \circ \lambda x(x \bullet (\textit{read} \bullet (\textit{the} \bullet ((\mathrm{NP}\backslash\!\!\backslash\mathrm{S})/\!\!/((\mathrm{N}/\mathrm{N})\backslash\!\!\backslash(\mathrm{NP}\backslash\!\!\backslash\mathrm{S})) \bullet \textit{book})))) \vdash \mathrm{S} & /\!\!/ L \\ \hline
\mathrm{S}/\!\!/(\mathrm{NP}\backslash\!\!\backslash\mathrm{S}) \bullet (\textit{read} \bullet (\textit{the} \bullet ((\mathrm{NP}\backslash\!\!\backslash\mathrm{S})/\!\!/((\mathrm{N}/\mathrm{N})\backslash\!\!\backslash(\mathrm{NP}\backslash\!\!\backslash\mathrm{S})) \bullet \textit{book}))) \vdash \mathrm{S} & \lambda \\ \hline
\textit{everyone} \bullet (\textit{read} \bullet (\textit{the} \bullet (\textit{same} \bullet \textit{book}))) \vdash \mathrm{S} & \mathrm{LEX}
\end{array}
$$

[9] In the form of an inference rule, this structural postulate is written $\frac{\Sigma[\Gamma[p]] \vdash A}{\Sigma[p \circ \lambda x \Gamma[x]] \vdash A}$. See Moortgat (1997) or Restall (2000) for discussions of structural postulates.

First, we form a continuation of category $\text{NP}\backslash\!\!\backslash \text{S}$ suitable to serve as the nuclear scope of a quantifier in subject position (third line). Next, we construct the parasitic nuclear scope with category $(\text{N}/\text{N})\backslash\!\!\backslash(\text{NP}\backslash\!\!\backslash\text{S})$ (fifth line). The remainder of the derivation makes these nested continuations available to the quantifiers that need them (first *same* and then *everyone*, the reverse of the order in which they take scope).

The Curry-Howard labeling is completely standard. Each formula in the proof is labeled with a variable of the corresponding type. Left rules ($\backslash L$, $\backslash\!\!\backslash L$, $/L$, $/\!\!/L$) correspond to function application, and right rules ($\backslash R$ $\backslash\!\!\backslash R$, $/R$, $/\!\!/R$) lambda-bind a variable. Since the structural rule merely states that certain structures are equivalent, it has no effect on the semantics. If formulas in the final sequent are labeled with symbols that refer to their lexical meanings, we have:

$$\mathbf{everyone}(\mathbf{same}(\lambda f\, \lambda y.\mathbf{read}(\mathbf{the}(f(\mathbf{book})))\, y))$$

This is exactly the semantic composition provided by the discussion of parasitic scope above in Sect. 6. See Moortgat (1997, Sect. 3) for details concerning Curry-Howard labeling for multi-modal Lambek grammars.

7.1 Non-NP triggers

One striking advantage to the generality of the system given here is that it easily accounts for non-NP triggers. Carlson (1987) emphasizes that *same* and *different* can also distribute over other types of expressions besides NPs:

(50) a. John read and reviewed the same book. — V and V
b. John read the same book quickly and thoroughly. — Adv and Adv
c. John read the same book every day. — Quantificational Adv
d. John usually read the same book. — Quantificational Adv

As far as I know, this is the first explicit analysis of any scope-taking adjective occurring with non-NP triggers.

In order to handle non-NP triggers, it is necessary to generalize the lexical entry for parasitic *same* ever so slightly.

(51) Old: $(\text{NP}\backslash\!\!\backslash\text{S}) \,/\!\!/\, ((\text{N}/\text{N}) \backslash\!\!\backslash (\text{NP}\backslash\!\!\backslash\text{S}))$
New: $(\alpha\backslash\!\!\backslash\text{S}) \,/\!\!/\, ((\text{N}/\text{N}) \backslash\!\!\backslash (\alpha\backslash\!\!\backslash\text{S}))$

I have written out $\text{NP}\backslash\!\!\backslash\text{S}$ rather than the equivalent N for the scope target and the result, since we need to examine the internal structure in order to perceive the full correspondence between the old category and the new one. The only difference is that instead of targeting a category that specifically mentions NP (i.e., the scope target is $\text{NP}\backslash\!\!\backslash\text{S}$ in the original category), the generalized category targets the category $\alpha\backslash\!\!\backslash S$, where α is a meta-variable over categories.[10]

In continuation terms, $NP\backslash\!\!\backslash S$ is a clause that still needs an NP in order to be complete. Analogously, $\alpha\backslash\!\!\backslash S$ is a clause that still needs something of category α in order to be complete, whatever α turns out to be. If we choose $\alpha = NP$, we generate the standard examples in which the trigger is a plural or quantificational NP. But if we choose $\alpha = (NP\backslash S)/NP$—i.e., the category of a transitive verb—then we generate an instantiation of the schema that is appropriate when the trigger is a coordinate transitive verb.

The derivation of *John hit and killed the same man* is closely parallel to the derivation of parasitic scope given just above:

$$
\begin{array}{ll}
\vdots & \\
\textit{john} \bullet (\textsc{v} \bullet (\textit{the} \bullet (\textsc{n}/\textsc{n} \bullet \textit{man}))) \vdash \textsc{s} & \\ \hline
\textsc{v} \circ \lambda x(\textit{john} \bullet (x \bullet (\textit{the} \bullet (\textsc{n}/\textsc{n} \bullet \textit{man})))) \vdash \textsc{s} & \lambda \\ \hline
\lambda x(\textit{john} \bullet (x \bullet (\textit{the} \bullet (\textsc{n}/\textsc{n} \bullet \textit{man})))) \vdash \textsc{v}\backslash\!\!\backslash\textsc{s} & \backslash\!\!\backslash R \\ \hline
\textsc{n}/\textsc{n} \circ \lambda y\lambda x(\textit{john} \bullet (x \bullet (\textit{the} \bullet (y \bullet \textit{man})))) \vdash \textsc{v}\backslash\!\!\backslash\textsc{s} & \lambda \\ \hline
\lambda y\lambda x(\textit{john} \bullet (x \bullet (\textit{the} \bullet (y \bullet \textit{man})))) \vdash (\textsc{n}/\textsc{n})\backslash\!\!\backslash(\textsc{v}\backslash\!\!\backslash\textsc{s}) \qquad \textsc{v}\backslash\!\!\backslash\textsc{s} \vdash \textsc{v}\backslash\!\!\backslash\textsc{s} & \backslash\!\!\backslash R \\ \hline
(\textsc{v}\backslash\!\!\backslash\textsc{s})/\!\!/((\textsc{n}/\textsc{n})\backslash\!\!\backslash(\textsc{v}\backslash\!\!\backslash\textsc{s})) \circ \lambda y\lambda x(\textit{john} \bullet (x \bullet (\textit{the} \bullet (y \bullet \textit{man})))) \vdash \textsc{v}\backslash\!\!\backslash\textsc{s} & /\!\!/L \\ \hline
\lambda x(\textit{john} \bullet (x \bullet (\textit{the} \bullet ((\textsc{v}\backslash\!\!\backslash\textsc{s})/\!\!/((\textsc{n}/\textsc{n})\backslash\!\!\backslash(\textsc{v}\backslash\!\!\backslash\textsc{s})) \bullet \textit{man})))) \vdash \textsc{v}\backslash\!\!\backslash\textsc{s} \qquad \textsc{s} \vdash \textsc{s} & \lambda \\ \hline
\textsc{s}/\!\!/(\textsc{v}\backslash\!\!\backslash\textsc{s}) \circ \lambda x(\textit{john} \bullet (x \bullet (\textit{the} \bullet ((\textsc{v}\backslash\!\!\backslash\textsc{s})/\!\!/((\textsc{n}/\textsc{n})\backslash\!\!\backslash(\textsc{v}\backslash\!\!\backslash\textsc{s})) \bullet \textit{man})))) \vdash \textsc{s} & /\!\!/L \\ \hline
\textit{john} \bullet (\textsc{s}/\!\!/(\textsc{v}\backslash\!\!\backslash\textsc{s}) \bullet (\textit{the} \bullet ((\textsc{v}\backslash\!\!\backslash\textsc{s})/\!\!/((\textsc{n}/\textsc{n})\backslash\!\!\backslash(\textsc{v}\backslash\!\!\backslash\textsc{s})) \bullet \textit{man}))) \vdash \textsc{s} & \lambda \\ \hline
\textit{John} \bullet (\textit{hit-and-killed} \bullet (\textit{the} \bullet (\textit{same} \bullet \textit{man}))) \vdash \textsc{s} & \text{LEX}
\end{array}
$$

The complex phrase *hit and killed* has category $\textsc{v} = (\textsc{np}\backslash\textsc{s})/\textsc{np}$. Thanks to the availability of LIFTing, this (complex) transitive verb can take scope over the S that contains it, creating a continuation of category $\textsc{v}\backslash\!\!\backslash\textsc{s}$. We then construct the parasitic continuation $(\textsc{n}/\textsc{n})\backslash\!\!\backslash(\textsc{v}\backslash\!\!\backslash\textsc{s})$ to serve as the argument to the generalized *same*. For the Curry-Howard labeling, we have

$$(\mathbf{same}(\lambda f \lambda R.R\,(\mathbf{the}(f(\mathbf{man}))\,\mathbf{j})))(\mathbf{hit\ and\ killed})$$

The analysis here makes concrete and explicit the exact analogy between the way in which conjoined NPs give rise to an internal reading with *same* and the way in which conjoined transitive verbs (and other triggers) do.

In general, the scope-taking mechanism allows *same* to target any element in the clause, subject to the semantic constraint that it provides a denotation suitable for distributing over.

[10] In a more comprehensive grammar, it would be necessary to distinguish between the category of a nominal and the category $NP\backslash\!\!\backslash S$. The generality of this proposed lexical entry for *same* can be preserved, however, as long as the category for nominals is a continuation whose result is S. For instance, we could choose $N = E\backslash\!\!\backslash S$, where E is an abstract category with semantic type e.

7.2 Generalized distributivity

Generalizing the semantics is trivial.

(52) $[\![same]\!] = \lambda F_{\langle \mathrm{Adj,N} \rangle} \lambda \mathcal{X}.\exists f_{\mathtt{choice}} \forall x < \mathcal{X} : Ffx$

The only change I have made from the original denotation proposed for NP-internal uses in (33) above is that I have refrained from typing the variable $\mathcal{X}$ (in recognition of which I have set it in a curly face), which we now allow to range over any type. (In computer science jargon, the denotation for *same* is now type-polymorphic.)

In order for this to work, we must assume that the relevant semantic domains have a boolean structure (in the sense of Keenan and Faltz (1985)), including at least closure under a join operation—i.e., that there is a transitive verb denotation $[\![read]\!] \oplus [\![reviewed]\!]$ which is the join of the transitive verb meanings $[\![read]\!]$ and $[\![reviewed]\!]$. See Krifka (1990b) especially for discussion of the pluralization of adjectives (e.g., *the flag is green and white*).

In addition, the part relation $<$ must be well-defined over each of the domains that are capable of triggering an internal reading for *same*. In the example at hand, we must assume that $<$ is the dominates relation induced by the boolean join structure over the set of transitive verb meanings, so that if *hit and killed* denotes the complex relation $[\![hit]\!] \oplus [\![killed]\!]$, then $[\![hit]\!] < ([\![hit]\!] \oplus [\![killed]\!])$ and $[\![killed]\!] < ([\![hit]\!] \oplus [\![killed]\!])$. This predicts the following truth conditions:

(53)a. John hit and killed the same man.

b. $(\mathbf{same}(\lambda f \lambda R.R(\mathbf{the}(f\,\mathbf{man}))(\mathbf{j}))(\mathbf{hit} \oplus \mathbf{killed})$

c. There is a non-atomic relation of (hitting $\oplus$ killing) such that
there is a choice function f such that
for all proper parts α of(hitting $\oplus$ killing),
John did α to f(man).

As noted by Carlson (1987), the distributive quantification built into the meaning of *same* only quantifies over verbal meanings that correspond to distinct events. That is, although it is possible to describe a single striking event as both a hitting and a killing (*David hit and killed Goliath*), the internal reading of *same* forces the subparts of the complex relation to correspond to separate events. Thus on the internal reading of (53), the hitting and the killing must be two distinct events. But this is what we would expect if the quantification built into the meaning of *same* behaves like normal quantification, which always quantifies over distinct elements in any domain.

7.3 Short digression on buying versus selling

The way that the distributivity built into *same* insists on distinct events bears on a long-standing issue relating to the nature of events. On a neo-Davidsonian conception of thematic relations (e.g., Parson 1990), each event must have a unique agent, a unique theme, and so on. Since every buying event is necessarily also a selling event, and since the agent of a buying event is the recipient of a selling event, it follows that buying and selling must count as distinct events, despite necessarily occupying the same physical space during the same moments of time.

(54) John bought and Mary sold the same book.

This sentence has an internal interpretation on which John was in the habit of buying a certain type of book and Mary was in the habit of selling the same type of book. That reading is facilitated (and may even require) that John bought the relevant books from someone other than Mary, and Mary sold her books to someone other than John.

But if buying and selling truly are distinct events, we should expect a different internal reading on which (54) describes a single transaction. Imagine, then, that John bought a book from Mary, and that was the only book John ever bought in his life, as well as the only book that Mary ever sold. Native speakers uniformly report that (54) cannot be used to describe that transaction. The obvious conclusion is that buying and selling do not in fact count as distinct events, at least, not according to the standards of *same*.

7.4 An equivalent logic with standard postulates

The postulate given above expresses the logic of scope-taking, including parasitic scope-taking, remarkably succinctly. However, as mentioned above, it is a somewhat unusual postulate. In this section I give a somewhat more cumbersome but equivalent logic. Although a thorough investigation of the properties of these logics is deferred to Barker and Shan (in prep), I will mention that the logic given in this subsection is sound and complete with respect to the same class of models constructed in Restall (2000). Furthermore, his proof of soundness and completeness in Sect. 11.3 carries over directly.

There are a number of Type Logical analyses that address scope-taking. It is worth noting that the rule of use for Moortgat's (e.g., 1997) q type constructor ('q' for quantification) is a theorem in this logic, where $q(A, B, C)$ is implemented as $C/\!\!/(A\backslash\!\!\backslash B)$. But q will not suffice for describing parasitic scope. The reason is that, as illustrated in the two derivations immediately above, in order to recognize the nuclear scope of a host quantifier as a constituent (the essence of parasitic scope), we must be free to reason about continuations of the form $A\backslash\!\!\backslash B$ independently of the quantifiers that take them as arguments. There simply is no way to separate out just the first and the second elements of a q formula.

Bernardi and Moortgat (2007) give a logic with explicit use of continuations that provides a suitably residuated pair of connectives for quantification; but on their system the nuclear scope of a quantifier is nevertheless not a logical constituent. As a result, it is not clear how to provide a description of the truth conditions of quantificational adjectives in their system.

Finally, Barker and Shan (2006) provide a continuation-based logic that could be extended (with a proliferation of modes and postulates) to approximate the system here for any given fixed maximum number of holes per structure. All of the examples discussed in this paper can be handled by setting a maximum of two holes; whether there are natural language expressions that require three holes (i.e., are doubly-parasitic) is an empirical question.

Given the same two modes above, with the same logical rules, we replace the single structural postulate above with the following three postulates:

$$\frac{p}{p \circ \mathsf{I}}\,\mathsf{I} \qquad \frac{p \bullet (q \circ r)}{q \circ ((\mathsf{B} \bullet p) \bullet r)}\,\mathsf{B} \qquad \frac{(p \circ q) \bullet r}{p \circ ((\mathsf{C} \bullet q) \bullet r)}\,\mathsf{C}$$

The symbols I, B, and C are zero-arity structural connectives. I is a right identity, of course. B and C are named after two of Curry's combinators for reasons explained in Barker and Shan (in prep).

I will illustrate how these postulates give parasitic scope by showing how it handles *The same waiter served everyone.*

$$\begin{array}{cl}
\vdots & \\
(\mathit{the} \bullet (\mathrm{N/N} \bullet \mathit{waiter})) \bullet (\mathit{served} \bullet \mathrm{NP}) \vdash \mathrm{S} & \mathsf{I} \\
\hline
(\mathit{the} \bullet (\mathrm{N/N} \bullet \mathit{waiter})) \bullet (\mathit{served} \bullet (\mathrm{NP} \circ \mathsf{I})) \vdash \mathrm{S} & \mathsf{B} \\
\hline
(\mathit{the} \bullet (\mathrm{N/N} \bullet \mathit{waiter})) \bullet (\mathrm{NP} \circ ((\mathsf{B} \bullet \mathit{served}) \bullet \mathsf{I})) \vdash \mathrm{S} & \mathsf{B} \\
\hline
\mathrm{NP} \circ ((\mathsf{B} \bullet (\mathit{the} \bullet (\mathrm{N/N} \bullet \mathit{waiter}))) \bullet ((\mathsf{B} \bullet \mathit{served}) \bullet \mathsf{I})) \vdash \mathrm{S} & \backslash\!\!\backslash R \\
\hline
(\mathsf{B} \bullet (\mathit{the} \bullet (\mathrm{N/N} \bullet \mathit{waiter}))) \bullet ((\mathsf{B} \bullet \mathit{served}) \bullet \mathsf{I}) \vdash \mathrm{NP}\backslash\!\!\backslash\mathrm{S} & \mathsf{I} \\
\hline
(\mathsf{B} \bullet (\mathit{the} \bullet ((\mathrm{N/N} \circ \mathsf{I}) \bullet \mathit{waiter}))) \bullet ((\mathsf{B} \bullet \mathit{served}) \bullet \mathsf{I}) \vdash \mathrm{NP}\backslash\!\!\backslash\mathrm{S} & \mathsf{C} \\
\hline
(\mathsf{B} \bullet (\mathit{the} \bullet (\mathrm{N/N} \circ ((\mathsf{C} \bullet \mathsf{I}) \bullet \mathit{waiter})))) \bullet ((\mathsf{B} \bullet \mathit{served}) \bullet \mathsf{I}) \vdash \mathrm{NP}\backslash\!\!\backslash\mathrm{S} & \mathsf{B} \\
\hline
(\mathsf{B} \bullet (\mathrm{N/N} \circ ((\mathsf{B} \bullet \mathit{the}) \bullet ((\mathsf{C} \bullet \mathsf{I}) \bullet \mathit{waiter})))) \bullet ((\mathsf{B} \bullet \mathit{served}) \bullet \mathsf{I}) \vdash \mathrm{NP}\backslash\!\!\backslash\mathrm{S} & \mathsf{B} \\
\hline
(\mathrm{N/N} \circ ((\mathsf{B} \bullet \mathsf{B}) \bullet ((\mathsf{B} \bullet \mathit{the}) \bullet ((\mathsf{C} \bullet \mathsf{I}) \bullet \mathit{waiter})))) \bullet ((\mathsf{B} \bullet \mathit{served}) \bullet \mathsf{I}) \vdash \mathrm{NP}\backslash\!\!\backslash\mathrm{S} & \mathsf{C} \\
\hline
\mathrm{N/N} \circ ((\mathsf{C} \bullet ((\mathsf{B} \bullet \mathsf{B}) \bullet ((\mathsf{B} \bullet \mathit{the}) \bullet ((\mathsf{C} \bullet \mathsf{I}) \bullet \mathit{waiter})))) \bullet ((\mathsf{B} \bullet \mathit{served}) \bullet \mathsf{I})) \vdash \mathrm{NP}\backslash\!\!\backslash\mathrm{S} & \backslash\!\!\backslash R \\
\hline
((\mathsf{C} \bullet ((\mathsf{B} \bullet \mathsf{B}) \bullet ((\mathsf{B} \bullet \mathit{the}) \bullet ((\mathsf{C} \bullet \mathsf{I}) \bullet \mathit{waiter})))) \bullet ((\mathsf{B} \bullet \mathit{served}) \bullet \mathsf{I})) \vdash (\mathrm{N/N})\backslash\!\!\backslash(\mathrm{NP}\backslash\!\!\backslash\mathrm{S}) \qquad \mathrm{NP}\backslash\!\!\backslash\mathrm{S} \vdash \mathrm{NP}\backslash\!\!\backslash\mathrm{S} & /\!\!/L \\
\hline
(\mathrm{NP}\backslash\!\!\backslash\mathrm{S})/\!\!/((\mathrm{N/N})\backslash\!\!\backslash(\mathrm{NP}\backslash\!\!\backslash\mathrm{S})) \circ ((\mathsf{C} \bullet ((\mathsf{B} \bullet \mathsf{B}) \bullet ((\mathsf{B} \bullet \mathit{the}) \bullet ((\mathsf{C} \bullet \mathsf{I}) \bullet \mathit{waiter})))) \bullet ((\mathsf{B} \bullet \mathit{served}) \bullet \mathsf{I})) \vdash \mathrm{NP}\backslash\!\!\backslash\mathrm{S} & \mathrm{LEX} \\
\hline
\mathit{same} \circ ((\mathsf{C} \bullet ((\mathsf{B} \bullet \mathsf{B}) \bullet ((\mathsf{B} \bullet \mathit{the}) \bullet ((\mathsf{C} \bullet \mathsf{I}) \bullet \mathit{waiter})))) \bullet ((\mathsf{B} \bullet \mathit{served}) \bullet \mathsf{I})) \vdash \mathrm{NP}\backslash\!\!\backslash\mathrm{S} & \mathsf{C} \\
\hline
(\mathit{same} \circ ((\mathsf{B} \bullet \mathsf{B}) \bullet ((\mathsf{B} \bullet \mathit{the}) \bullet ((\mathsf{C} \bullet \mathsf{I}) \bullet \mathit{waiter})))) \bullet ((\mathsf{B} \bullet \mathit{served}) \bullet \mathsf{I}) \vdash \mathrm{NP}\backslash\!\!\backslash\mathrm{S} & \mathsf{B} \\
\hline
(\mathsf{B} \bullet (\mathit{same} \circ ((\mathsf{B} \bullet \mathit{the}) \bullet ((\mathsf{C} \bullet \mathsf{I}) \bullet \mathit{waiter})))) \bullet ((\mathsf{B} \bullet \mathit{served}) \bullet \mathsf{I}) \vdash \mathrm{NP}\backslash\!\!\backslash\mathrm{S} & \mathsf{B} \\
\hline
(\mathsf{B} \bullet (\mathit{the} \bullet (\mathit{same} \circ ((\mathsf{C} \bullet \mathsf{I}) \bullet \mathit{waiter})))) \bullet ((\mathsf{B} \bullet \mathit{served}) \bullet \mathsf{I}) \vdash \mathrm{NP}\backslash\!\!\backslash\mathrm{S} & \mathsf{C} \\
\hline
(\mathsf{B} \bullet (\mathit{the} \bullet ((\mathit{same} \bullet \mathsf{I}) \bullet \mathit{waiter}))) \bullet ((\mathsf{B} \bullet \mathit{served}) \bullet \mathsf{I}) \vdash \mathrm{NP}\backslash\!\!\backslash\mathrm{S} & \mathsf{I} \\
\hline
(\mathsf{B} \bullet (\mathit{the} \bullet (\mathit{same} \bullet \mathit{waiter}))) \bullet ((\mathsf{B} \bullet \mathit{served}) \bullet \mathsf{I}) \vdash \mathrm{NP}\backslash\!\!\backslash\mathrm{S} \qquad \mathrm{S} \vdash \mathrm{S} & /\!\!/L \\
\hline
\mathrm{S}/\!\!/(\mathrm{NP}\backslash\!\!\backslash\mathrm{S}) \circ ((\mathsf{B} \bullet (\mathit{the} \bullet (\mathit{same} \bullet \mathit{waiter}))) \bullet ((\mathsf{B} \bullet \mathit{served}) \bullet \mathsf{I})) \vdash \mathrm{S} & \mathrm{LEX} \\
\hline
\mathit{everyone} \circ ((\mathsf{B} \bullet (\mathit{the} \bullet (\mathit{same} \bullet \mathit{waiter}))) \bullet ((\mathsf{B} \bullet \mathit{served}) \bullet \mathsf{I})) \vdash \mathrm{S} & \mathsf{B} \\
\hline
(\mathit{the} \bullet (\mathit{same} \bullet \mathit{waiter})) \bullet (\mathit{everyone} \circ ((\mathsf{B} \bullet \mathit{served}) \bullet \mathsf{I})) \vdash \mathrm{S} & \mathsf{B} \\
\hline
(\mathit{the} \bullet (\mathit{same} \bullet \mathit{waiter})) \bullet (\mathit{served} \bullet (\mathit{everyone} \circ \mathsf{I})) \vdash \mathrm{S} & \mathsf{I} \\
\hline
(\mathit{the} \bullet (\mathit{same} \bullet \mathit{waiter})) \bullet (\mathit{served} \bullet \mathit{everyone}) \vdash \mathrm{S} &
\end{array}$$

The Curry-Howard labeling is exactly the compositional structure expected from Sect. 6 above:

$$\mathbf{everyone}(\mathbf{same}(\lambda f \lambda x.\mathbf{served}(\mathbf{the}(f(\mathbf{waiter})))(x)))$$

The strategy of this derivation is the same as with the derivations above using the single-postulate logic, though considerably more inferences are required when moving stepwise rather than in one long jump. Although I will not emphasize the point here, the multiple-postulate implementation (but not the single-postulate one) is directly compositional in the sense of Jacobson (1999): in particular, every syntactic constituent has a well-formed semantic interpretation. The status of Type Logical grammars such as the one here with respect to direct compositionality is discussed in detail in Barker (2007).

8 Conclusions

In unpublished work, Heim (1985) sketches an approach to *same* and *different* with intriguing similarities and differences to the proposal here. She suggests that *John and Bill read the same book* means roughly

$$\mathbf{same}(\{\mathbf{j}, \mathbf{b}\})(\lambda x \iota y.(\mathbf{read}\, y\, x) \wedge (\mathbf{book}\, y))$$

Unlike the analysis here, the contribution of *same* is split into two parts: a logical predicate **same**, which takes scope above the subject, and a binding operator ι, which takes scope below the subject. (See Hackl (2001, Sect. 3.2) on exploiting "scope splitting" for comparative quantifiers.) Instead of λ, as here, Heim has ι; instead of scoping just outside of the nuclear scope of the subject, as *same* does here, the ι part scopes just inside. Without more details of how Heim's logical forms are to be generated, it is hard to tell which of these differences are essential (if any).

In any case, Heim's goal is to emphasize what *same* and *different* have in common with comparatives and superlatives. The goal here is to find a strictly compositional analysis on which *same* makes a unitary (unsplit) contribution to the semantics; to explain why it is natural for some adjectives to take scope (because LIFT is generally available); to explain why it makes sense for *same* to take scope over nominals (because the nature of LIFT predicts that scope-taking adjectives naturally take scope over nominals); and to understand the formal nature of parasitic scope (it depends on building a continuation whose argument is itself a continuation).

8.1 Related constructions

I have concentrated mostly on *same* in this paper, but Keenan (1992) identifies a number of other constructions that also lie beyond the Frege boundary, some of which may also have compositional semantic analyses along the lines suggested here for *same*. Stump, Carlson, Keenan and others observe that *same* and *different* are far from the only adjectives that pose similar challenges for compositional treatments. Other adjectives mentioned by Carlson include *distinct, separate*, and *similar*. (Indeed, I suspect that *similar* is a better candidate to serve as the dual of *different* than *same* is.) In addition, other adjectives that may take nominal scope include *identical, unrelated, mutually incompatible*, and *opposite*.

Prime among these, of course, is *different*.

(55) a. John read and reviewed different books.

b. $[\![different]\!] = \lambda F.\lambda X \forall f_{\texttt{choice}} \forall x, y < X : (Ffx \wedge Ffy) \rightarrow x = y$

As near as I can tell, this denotation gives reasonable truth conditions for NP-internal uses, parasitic uses distributing over an NP denotation, as well as uses with a non-NP trigger as in (55a).

Deciding whether this analyses for *different* gives good results requires careful consideration of the arguments concerning *different* presented in Beck (2000). In addition, any comprehensive proposal for describing the class of scope-taking adjectives must take into account detailed empirical studies of how the availability of internal readings depends on the choice of adjective, such as that of Dotlacil and Nilsen (2007).

Keenan also draws attention to resumptive uses of *same* and *different*:

(56) a. The same people ordered the same dishes.

b. Different students answered different questions.

What is intriguing about the internal reading of (6a) is that not only must the same group of people end up ordering the same collection of dishes, each person in the group must order the same dish that that person ordered the last time. I will not attempt a complete analysis of resumptive uses here, except to speculate that the first *same* may be a deictic use. In contrast, for (56b), the first occurrence of *different* seems to me to have trivial scope (that is, having scope over the minimal N as discussed above in Sect. 5.6).

8.2 Summary

Whether the analysis makes use of movement and LF or not, the approach here depends on constructing continuations. In particular, whenever *same* takes parasitic scope, its scope must be defined in terms of the continuation of some other expression (the trigger) elsewhere in the clause.

To summarize, I am proposing the following general analysis for *same*:

(57) a. $(\alpha \backslash\!\!\backslash \mathrm{S}) /\!\!/ ((\mathrm{N}/\mathrm{N}) \backslash\!\!\backslash (\alpha \backslash\!\!\backslash \mathrm{S}))$ syntax

b. $\lambda F_{\langle \mathrm{Adj,N} \rangle} \lambda \mathcal{X}.\exists f_{\texttt{choice}} \forall x < \mathcal{X} : Ffx$ semantics

Given a suitably general theory of scope-taking (in particular, one that allows a scope-taking element to take scope over the nuclear scope of some other operator), this single schematic lexical entry accounts for NP-internal uses, parasitic uses with NP triggers, and parasitic uses with non-NP triggers.

Thus continuations provide novel and potentially insightful compositional analyses even in the realm beyond the Frege boundary.

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