A QUANTIFICATIONAL DISCLOSURE APPROACH TO JAPANESE AND KOREAN INTERNALLY-HEADED RELATIVES

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ABSTRACT

Grosu 2010 (*JEAL* 19:231-274) argues against analyses of Japanese and Korean internally headed relative clauses in terms of discourse anaphora, and in favor of an analysis which postulates a functional category ChR in the syntax of these constructions, the semantics of which allows quantificational disclosure.

The present paper constitutes a follow-up on Grosu, with the inter-related goals of (i) strengthening Grosu's arguments against discourse anaphora approaches and in favor of a grammar-based quantificational disclosure approach, (ii) improving substantively on the syntactic and semantic characterization of the functional category ChR (Choose Role), and (iii) justifying the introduction of additional mechanisms that render that analysis adequate with respect to a substantially wider set of data types.

The proposals made in the present paper strengthen Grosu's central thesis, which is that, despite undeniable partial similarities to discourse anaphora, Japanese and Korean internally-headed relatives are *bona fide* relatives. The paper shows the semantic fruitfulness of this analysis by discussing a series of examples of increasing semantic complexity, and by arguing that Japanese and Korean internally-headed relatives provide striking evidence for a semantic scope mechanism that has been independently discussed in the context of the semantics of plurality and cumulative readings: a mechanism that allows part of the meaning of (argument) noun phrases to take local (adverbial) scope.

KEYWORDS
Internally headed relative clauses, discourse anaphora, event semantics, scope dependencies, scopeless interpretations

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This paper is a follow-up on Grosu 2010 (henceforth: G). It has three inter-related goals.
(i) We refine and strengthen the argumentation put forward in G against discourse anaphora approaches to Japanese and Korean internally headed relative constructions, and in favor of a grammar-based quantificational disclosure approach, by discussing the relevant data in more detail.
(ii) We offer an improved empirical and theoretical account of the characterization of the functional category ChR (*Choose Role*), which lies at the heart of the quantificational disclosure approach set out in G.
(iii) We show that a grammatical mechanism of local, dependent scope – which is independently justified in the analysis of semantic plurality and cumulative readings - allows for a straightforward extension of the analysis to cases where the internal head is in the scope of a distributive quantifier. We argue that the simplicity of the resulting analysis is in sharp contrast with the complexity of existing analyses of comparable data with discourse anaphora (see, e.g., Krifka 1996), a complexity that would be carried over to a discourse anaphora approach to internally headed relatives.

This paper is self-contained, but the reader may of course wish to consult G for a more detailed presentation and discussion of the issues brought up in section 1, as well as of issues that will not be addressed in detail here (in particular, those that concern aspectual restrictions on internally-headed relative constructions and the optimal division of labor between semantics and pragmatics in dealing with them, which are addressed in G's sections 4 and 5).

The remainder of the paper is organized as follows. Section 1 argues in more detail that Japanese and Korean internally headed relatives show a sensitivity to island constraints that discourse anaphora constructions lack. Section 2 points out the need for certain modifications in G's characterization of ChR(P), which are minimally necessary to ensure empirical adequacy with respect to the data analyzed in detail by G. Section 3 presents the current analytical proposal in somewhat more detail than was done in G. Sections 4 and 5 address more complex data, whose treatment was not developed in detail in G. Section 6 is a summary of results.

1 Japanese and Korean internally headed relative clauses and island effects.

The internally-headed relative constructions of Japanese/Korean differ in interesting ways from the kinds of internally-headed relative constructions found in other languages, in particular, in languages like Lakhota, where the internal head is a predicate bound by a relative-external determiner (Williamson 1987), and in languages like Navajo, where the internal head, although bound by a quantifier internal to the relative in overt representation, is nonetheless construed with relative-external scope (Faltz 1995). In contrast, in Japanese and Korean, the internal head is locally bound by a determiner that has relative-internal scope and does not express the quantificational force of the entire internally-headed relative construction, the latter being invariably definite. The properties just noted have led a number of researchers, in particular, Hoshi 1995, Shimoyama 1999, 2001 and Kim 2007 to propose analyses that crucially rely on the E-type strategy found in discourse, sometimes with added constraints, the most extensive attempt to capture such constraints with precision being found in Kim 2007.

G argued against appealing to the E-type strategy on both conceptual and empirical grounds, focusing primarily on Kim's attempt to constrain its use, and showing that her account was on the wrong track in at least two important ways: (a) by attempting to build into the formal semantic analysis an aspect of Kuroda's 1976-1977 'Relevancy Condition', which, G argued, needs to be relegated to the pragmatics (see his section 5), and (b) by failing to allow for more deeply embedded internal heads, and by failing to capture the fact that this option is constrained by Subjacency.

On the E-type approach, *internally headed relative clause* is really a misnomer, since on this approach the construction isn't a relative clause, that is, a construction with a predicate meaning formed by abstraction over a grammatically introduced variable. In contrast, in Gs analysis internally headed relatives are true relatives. According to G, the only 'special' feature of these constructions is that the 'visible pivot' of the construction, i.e., its internal head, does not itself semantically introduce a semantic variable that can form the basis for predicate formation at the relative clause level. Rather, a suitable variable is introduced in the semantics *via* the category ChR. The semantics of this category introduces this variable as the value of a role which is semantically linked to the event type containing the interpretation of the pivot, achieving the effects of quantificational disclosure (similar to the mechanisms discussed in Dekker 1993 and Grosu and Landman 1998). G assumes that the relevant variable is bound as part of the interpretation of a syntactic operator-variable construction. With this, G predicts major differences between the grammatical properties of internally headed relatives and discourse anaphora constructions: the first are predicted to be sensitive to island constraints, while discourse anaphora – as a pragmatic phenomenon - does not show island effects.

We will now discuss the data concerning island effects in more detail. Watanabe 1992, 2003 pointed out the contrast between (1a) and (1b) (= G's (29a) and (10a) respectively).

(1) a. Mary-ga [John-ga [zibun-no gakusei-ga **juuyouna kasetsu-o**
Mary-Nom [John-Nom [self-Gen student-Nom **important hypothesis-Acc**
teian-shi-ta to] jimanshite-ita-no]-no kekkan-o shiteki-shi-ta.
propose-do-past Czer] boasted-had- no]-Gen defect-Acc point.out-do-past
'John had boasted that his student proposed **an important hypothesis**
and Mary pointed out a defect in **it**.'

b. *Mary-ga [John-ga [**atarashii kasetu**-o teianshita *gakusei*-o]
Mary-Nom [John-Nom [**new hypothesis**-Acc proposed student-acc]
homete-ita-no]-no kekkan-o shitekishita.
praise-had- no]-Gen defect-Acc pointed-out
'John praised the *student* [who proposed **a new hypothesis**] and Mary
pointed out a defect in **it**.'

In (1a) *jimanshite* 'boast' takes a CP complement and the internally headed relative can be analyzed as this complement; in (1b) *homete* 'praise' takes a noun phrase complement, which means that the internally headed relative must be analyzed as a relative clause on the head *gakusei* 'student.' This means that the internal head *atarashii*

kasetu-o/new hypothesis is in an island in (1b), unlike *juuyouna kasetsu-o/important hypothesis* in (1a).

However, one of the referees for this paper (who we will call referee B) found both (1a) and (1b) unacceptable, noting that many of his/her consultants generally dislike internally headed relatives bearing the Genitive Case marker *–no* (as is the case in both examples in (1)), thereby questioning the case for island sensitivity.

Akira Watanabe (p.c.) kindly drew our attention to the fact that judgments concerning internally headed relatives in Japanese are subject to a great deal of idiolectical variation, and our own experience with consultants, limited as it was, fully confirms this impression (not only with respect to Japanese, but also with respect to Korean).

Thus, some speakers of Japanese (e.g., Kazuko Yatsushiro) reject internally headed relatives altogether. Others, like referee B and his/her consultants reject (1a) and (1b). Other speakers, e.g. Akira Watanabe, Yusuke Imanishi, Junya Nomura, and the other referee for this paper (who we will call referee A) accept (1a) and reject (1b). In fact, referee A rejects (1b), but accepts (1a) *even* if the noun *jujitsu* 'fact' is substituted for the complementizer *to* in (1a). in which case the internal head is internal to a noun complement, but rejects (1b). Similar to this, Akira Watanabe (p.c.) proposes example (1c) and judges that, while (1c) is not as felicitous as (1a), (1a) and (1c) together contrast strongly with (1b), which everybody we have consulted agrees is completely out.

(1) c. Mary-ga [John-ga [zibun-no gakusei-ga **juuyouna kasetsu-o**
Mary-Nom [John-Nom [self-Gen student-Nom **important hypothesis-Acc**
teian-shi-ta {to, ?jijitsu-o}] houkokushite-ita-no]-no kekkan-o
propose-do-past Czer fact-acc] reported-had- no]-Gen defect-Acc
shiteki-shi-ta.
point.out-do-past
'John had reported (the fact) [that his student proposed an important hypothesis] and Mary pointed out a defect in it.'

A comparable pattern of variation seems to exist in Korean.

(2) a. Mary-ka [John-i [caki-uy haksayng-i **cwungyohan kasel-ul**
Mary-nom [John.-nom [self-gen student-nom **important hypothesis-acc**
ceyanha-yss-ta-ko] calangha-n] kes-uy mwunceycem-ul cicekha-yss-ta.
propose-past boast-perf.rel] kes-gen problem-acc point.out-past-decl
'John had boasted that his student proposed **an important hypothesis** and Mary pointed out a defect in **it**.'

b. [[Mary-ka encey **pheyiphe-lul** khuthnay-nun-ci] John-i Tom-eykey
Mary-nom when **paper-acc** finish-perf.rel-Q] John-nom Tom-dat
mwul-ess-ten] kes-i chwulphan-toy-ess-ta.
ask-past-pluperf.rel] kes-nom publish-pass-past-decl
John had asked Tom when Mary would finish **a (certain) paper** and **that paper** was published.

c.*Mary-ka [John-i [**saylowun kasel-ul** ceyanha-n *haksayng-ul*]
Mary-nom [John-nom [**new hypothesis-acc** propose-perf.rel *student-acc*]
chingchanha-n] kes-uy mwunceycem-ul cicekha-yss-ta.
praise-perf.rel] kes-gen problem-acc point.out-past-decl
'John praised the *student* who proposed **a new hypothesis** and Mary pointed out a defect in **it**.'

Thus, Jae-Il Yeom rejects the Korean counterpart of (1a) (shown in (2a)). Dae Young Sohn finds it marginal, and Suyeon Yun finds it almost acceptable. At the same time, the last two consultants report that examples like (1a) improve if the clause containing the internal head is in a non-indicative mood, as in (2b): Dae Young Sohn rates this one as almost acceptable, and Suyeon Yun finds it fully acceptable. All three Korean speakers unhesitatingly reject the Korean counterpart of (1b), shown in (2c).

The Japanese counterpart of (2b) (= G's (30a), reproduced in (3)) is rated as fully acceptable by Watanabe 2003, Hoshi 1995 and Kuroda 1999 (on the fact that Japanese internally headed relatives are insensitive to the wh-island constraint, see Watanabe 2003).

(3) [[Mary-ga itsu **ronbun**-o shiageru-ka] John-ga Tom-ni tazunete-ita]-no-ga
Mary-nom when **paper-acc** finish-Q] John-nom Tom-dat asked-had]-no-nom
shuppan-sareta.
publish-pass

'John had asked Tom when Mary would finish **a (certain) paper** and **that paper** was published.'

The present findings are, of course, based on a small sample. Nevertheless, the important thing to note is that the patterns of variation found here are strongly reminiscent of the patterns associated with extraction processes in English and other Indo-European languages. Thus, from a cross-idiolectical perspective, extraction from verbal complements is sometimes harder than from simplex clauses, with the added observation that non-indicative complements tend to be more transparent than indicative ones; furthermore, extraction from noun complements is felt by some speakers to result in milder deviance than extraction from relative clauses, and at the same time, in stronger deviance than extraction from verb complements.

Crucially, none of these restrictions are found to be relevant for discourse anaphora: discourse anaphora is a pragmatic discourse phenomenon that is not sensitive to island constraints. This means that the judgements found in Japanese and Korean are totally unexpected if Japanese and Korean internally headed relatives are to be analyzed as a form of discourse anaphora, while they are well within the range of expectations on the analysis that treats internally headed relatives as true grammatical relatives. Hence the variation reported here provides strong support for the latter.

In the course of this paper, we will come across several other empirical differences between Japanese and Korean internally headed relatives and discourse anaphora constructions. However, since the discussion of the phenomena in question is

best related directly to the details of our proposal, we will discuss these at the appropriate points in this paper (see also G, for more discussion of the issue).

2. The category Choose Role

To capture the contribution of the internal head to the meaning of the internally-headed relative constructions, Kim 2007 proposes a lexical entry for *-no* (and its Korean counterpart *kes*) which is reproduced with inconsequential adaptations in (4).

(4) $[\![no/kes_{R,P}]\!]_g = \lambda s \lambda x.g(R)(x)(s)\ \&\ g(P)(x)$
where *s* is a variable over states, x over individuals, R over thematic roles and P over 'sufficiently salient' properties, and g is an assignment function.

(4) is a function that applies to a state and forms a predicate of individuals that serves as basis for the creation of an E-type anaphor in the matrix clause. The choice of an antecedent for this anaphor is limited to entities that play a thematic role in that state (a characterization that Kim took over from Shimoyama). The state to which (4) applies is generated by covertly raising the sister of *no/kes*, i.e., the relative CP, and by interpreting its trace as a state jointly defined by the VP and the AspectP of the relative clause (for details, see Kim 2007 or G).

G observes that Kim's analysis limits the operation of predicate formation in (4) to a participant in an eventuality *associated with the entire relative clause,* and does not permit an account of data in which the internal head is more deeply embedded, nor of the sensitivity of such embedding to island constraints. In order to deal with the facts just mentioned, G proposes to assume a (phonologically null) functional category ChR, to which he assigns the translation in (5).

(5) $[\![ChR]\!]_g = \lambda E \lambda e.E(e) \wedge (g(R))(e)=g(x)$
where E is a variable over sets of events, e over events, R over thematic roles, x is a free variable over individuals and g is an assignment function.

(5) exhibits certain similarities with (4), but also crucially differs from it in a number of respects. First and foremost, unlike *no/kes*, ChR is not a sister of (the trace of) the relative CP, but of some VP internal to the relative. This makes it possible to account for data with deeply embedded internal heads. Second, ChR makes it possible to account for island sensitivity, because it can in principle be endowed with a Specifier, which, if its presence can be coerced in some way, can serve as basis for launching a null operator that undergoes cyclic A-bar movement in the syntax. Third, ChR chooses the internal head directly from the set of events denoted by a VP, rather than from a state induced by an event, as (4) does; for justification of this simplification, see Gs footnote 11.

Note that (5), unlike (4), does not make reference to 'sufficiently salient' properties. The salient property P that restricts the individual variable is primarily invoked by Kim in order to deal with certain kinds of bridging effects. We postpone discussion of this issue until section 3.

While (5) improves over (4) in the ways indicated above, it still suffers from a number of shortcomings. One shortcoming, inherited from (4), is a non-optimal technical feature: the symbol 'g', which belongs to the meta-language, occurs in an expression of the object language. This technical defect will be rectified in section 3.

A second problem, this time empirical, stems from the way in which abstraction over the variable introduced by equation is executed. G proposed that abstraction is triggered at the relative clause level by the typing feature [PRED] on C. However, as pointed out to Alex Grosu by Radek Simik, this line of analysis does not ensure that predicate formation will target the variable introduced by ChR, in particular, in cases where the relative happens to include other free variables (e.g. variables denoted by unbound definite pronouns). Furthermore, abstraction is in no way related to the null operator that undergoes syntactic movement, so that the latter's presence in [Spec, ChR] requires a separate stipulation. Moreover, this operator plays no role in the semantics (G proposes to leave it uninterpreted). As pointed out by Radek Simik, these inadequacies can all be remedied by abstracting over the individual variable in the lexical entry of ChR in the way indicated in (6):

(6) $[\![\text{ChR}]\!]_g = \lambda E \lambda x \lambda e.E(e) \wedge (g(R))(e) = x$

To see this, observe first that in order to create no problems for the remainder of the derivation, ChRP must be of the same logical type as VP, so that it forms a suitable input to the next category, which, had ChRP not been present, would have combined with VP; that is to say, ChRP needs to end up denoting a set of events. In Gs analysis, this result is ensured by (5) in conjunction with the fact that [Spec, CP] is left un-interpreted (or, equivalently, is interpreted as the identity function on sets of events).

In the analysis we are proposing, the application of ChR as defined in (6), does not yield a set of events, but a relation between individuals and events. This needs to be turned into a set of events for the derivation to continue, and the natural way to do this is to merge in this position a null operator, whose trace can serve as argument of ChR', with the result that ChRP ends up denoting a set of events (the right type for combining with the next higher category, e.g., with Aspect or Tense), and furthermore the variable substituted for the one introduced by ChR necessarily gets bound by the null operator in [Spec, CP] of the relative (assuming co-indexation in the syntax of the null operator with its trace).

In short, the introduction of the null operator is no longer a step devoid of independent motivation, since it not only captures island-sensitivity, but also undergoes interpretation and – crucially – guarantees that abstraction applies to the 'right' variable.

Before considering the relative merits of (5) versus an E-type approach, we wish to briefly address the partly interrelated issues of the status of ChR in linguistic theorizing and of its cross- and intra-linguistic distribution.

Although, we do not have, at the moment, other cases where ChR is required, we neither think that ChR is an *ad hoc* stipulation, nor that it is a *sui generis* mechanism. ChR constitutes a 'salvaging' mechanism whose primary *raison d'être* is to make available a suitable interpretation for an otherwise closed sentence marked with the features [REL], [PRED].

In particular, ChR makes possible the 'reopening' of a closed sentence by providing an appropriate variable to which abstraction can apply, that is, it forms a quantificational disclosure mechanism. Similar operations have been discussed in the literature before. For instance, the analysis of passive in Landman 2000 lets the *by*-phrase add the agent role to the VP, even though the agent role is already existentially quantified over in the VP. Paul Dekker's operation of existential disclosure, from Dekker 1993, is similarly a role opener, and is used extensively in sentence internal syntax-semantics in Chierchia 1995, especially in the context of the semantics of Italian generic pronoun *si*. Related too is, in the context of relative clauses, the mechanism proposed in Grosu & Landman 1998, of abstraction over complex degrees that keep track of what they are degrees of, in order to deal with examples like (7), where a relativization gap occurs in a position open to the definiteness effect:

(7) The three books that there were on the desk seem to have disappeared.

(In fact, one could write a history of role-opening operations, finding somewhat similar examples already in semantic work in the early seventies.)

Concerning cross-linguistic distribution, it seems clear that ChR needs to be included in the inventory of functional categories on a language-specific basis, since not all languages have internally-headed relative constructions of the kind under consideration. Concerning intra-linguistic distribution in the languages that do allow such constructions, we suggest that over-generation will in general be avoided by independent factors. For example, in CPs that are not typed as predicates, their typing features (e.g., [DECLARATIVE], [INTERROGATIVE]) will be in conflict with the predicate-creating effects of ChR. As for the presence of (at least one token of) ChR within internally-headed relatives, it will in most cases be coerced by the need to satisfy the requirements of the feature [PRED] whenever the relative does not include pronouns denoting free individual variables. When such pronouns do exist, however, something additional needs to be done, because abstraction *per se* is island insensitive, and if a free pronoun occurs within an island, the island violation will not be analytically captured. Current minimalistic theorizing provides the mechanism of uninterpretable or unvalued features, which, unless 'checked' by an agreement operation, cause a derivational 'crash.' Rizzi 1990 proposed that English relative clauses be marked for the feature [wh], which, depending on its positive or negative specification, will require or disallow a wh-pronoun within the relative. Adapting this mechanism to the present situation, we may assume that internally-headed relatives are endowed not only with the feature [PRED], but also with a feature [ChR], which can only be checked by agreement with a token of ChR, whose presence is thus coerced. Do we wish to allow the merger of more than one token of ChR per internally-headed relative construction? If multiple tokens result in the relative CP denoting a relation, this will presumably be in conflict with the typing feature [PRED]. However, if multiple tokens result in a predicate-denoting CP, such a state of affairs need not be ruled out. In section 5, we will discuss constructions in which multiple tokens appear to be needed.

3. Choose role semantics

3.1. The theory.

In the next sections, we will show how the analysis deals with a variety of examples. Before that, we will, in this section, make some of the assumptions in G, as revised in the previous sections, more precise.

With G, we assume a neo-Davidsonian theory of events and plurality, as in Landman 2000, 2004. Semantically, the VP level is taken to be a level at which all the arguments of the verb are present, but at which existential closure of the event variable has not yet taken place.

The theory of plurality assumes that the relevant semantic domains are complete atomic Boolean algebras ordered by part-of operation $\sqsubseteq$ and sum operation $\sqcup$. The central notions here are:

(8) The pluralization *P of a predicate P is its closure under sum:
*P = {x: for some $X \subseteq P$: $x = \sqcup X$}
A singular role like Ag (agent) maps atomic events onto atomic individuals.
The pluralization *Ag of the role Ag lifts Ag to a plural role under the principle:
If $e = e_1 \sqcup \ldots \sqcup e_n$ then $*Ag(e) = Ag(e_1) \sqcup \ldots \sqcup Ag(e_n)$

Following Landman 2000, we assume that verbal predicates and roles are by default plural. For readability we will here assume the convention that we do not write the pluralization stars on verbal predicates and roles (we will write them on nouns).
With these conventions, we interpret the VP in (9a) as (9b), which can be paraphrased as (9c):

(9) a. Chris and Lee kissed Leslie and Hilary.
b. $\lambda e.KISS(e) \wedge Ag(e)=Chris \sqcup Lee \wedge Th(e) =Leslie \sqcup Hilary$
c. The set of all events e such that e is a sum of atomic kissing events and the sum of the agents of the atomic kissing events part of e is Chris $\sqcup$ Lee and the sum of the themes of the atomic kissing events part of e is Leslie $\sqcup$ Hilary

(10) Cardinality is counting of atomic parts: $|x| = |\{a \in ATOM: a \sqsubseteq x\}|$

(11) For each type a, $\perp_a$ is the undefined object of that type. We leave out the subscript.

The definiteness operation is the standard Sharvy-Link maximalization operation:

(12) Definiteness:

$$\sigma(P) = \begin{cases} \sqcup P \text{ if } \sqcup P \in P \\ \perp \quad \text{otherwise} \end{cases}$$

ET, the set of all **event types**, is the domain $D_{<e,t>}$ of all sets of events.

R, the set of all **roles**, is the domain $D_{<ed>}$ of functions from events to individuals.
K is the set of all **contexts**.

We define the salient role set for event type F in context k:

Let k be a context, $k \in \mathbf{K}$, and F an event type, $F \in \mathbf{ET}$.

(13) The **salient role set** for event type F in context k, $\mathbf{SR}_{k,F}$, is given by:
$\mathbf{SR}_{k,F} = \{R \in \mathbf{R}$: for all $e \in F$: $R(e) \neq \perp$ and R is salient in k$\}$
The set of all roles that are defined for all the events in F and that are salient in context k.

For event type F, $\mathbf{SR}_{k,F}$ is a subset of the set of all roles: we will only be interested in roles that are defined for all the events in F, and roles that are salient in k.
Normally, if the event type F corresponds to a VP, the normal salient roles are the roles explicitly introduced by the interpretation of the VP. We will see in section (5) an example of a context where a more complex role is made salient.

G introduces a functional category ChR, *Choose Role*, which takes the VP as its complement. The semantic interpretation of ChR applies to the event type interpretation of the VP *before* existential closure over the event variable.

We associate with the functional head ChR a constant $\boldsymbol{C}$ denoting *role choice function* $\boldsymbol{C}$, a function from contexts and event types to roles.

We interpret relative to context k:
$[\![\boldsymbol{C}]\!]_k = \mathbf{C}(k)$. We write $\mathbf{C}(k)$ as $\boldsymbol{C}_k$ and $\boldsymbol{C}(k,F)$ as $\boldsymbol{C}_{k,F}$.

(14) **Role choice function $\boldsymbol{C}$** is a function $\boldsymbol{C}$: $\mathbf{K} \times \mathbf{ET} \rightarrow \mathbf{R}$ such that:

$$\text{for all } k \in \mathbf{K}, F \in \mathbf{ET}: \begin{cases} \boldsymbol{C}_{k,F} \in \mathbf{SR}_{k,F} & \text{if } \mathbf{SR}_{k,F} \neq \emptyset \\ \boldsymbol{C}_{k,F} = \perp & \text{otherwise} \end{cases}$$

Thus, $\boldsymbol{C}_{k,F}$ maps context k and event type F onto a role that is defined for all events in F and that is salient in k, if there is such a role; otherwise it is undefined.

On this definition, the interpretation of expression $\boldsymbol{C}_\alpha(e)=x$ in context k presupposes that the interpretation of $\boldsymbol{C}_\alpha$ in k is a role salient in k and defined for every event in event type α (and in particular for e, if $e \in \alpha$).

Function $\boldsymbol{C}_k$ chooses for event type F a salient role defined on F, for instance, the (plural) role Th. Contexts are finegrained: we assume that the *choice* of the role is itself part of the context. Thus, there will be a context k' which only differs from k in that $\boldsymbol{C}_{k'}$ chooses for event type F the (plural) role Ag (if that is in $\mathbf{SR}_{k',F}$).

The semantics of the category *Choose Role* is that of a *role opener*. The VP that ChR takes as a complement has all the arguments in it and all the relevant adjuncts adjoined to it, so all relevant roles are in fact already filled.

What ChR does is reopen one of the roles that has already been filled inside the VP. The semantics of ChR discussed in the previous section can now be given the following form:

(15) $\lambda E \lambda x \lambda e.E(e) \wedge \boldsymbol{C}_{E}(e)=x$

In context k, ChR denotes a function that takes an event type E and maps it onto the relation that holds between events e and individuals x if e is in E and $\boldsymbol{C}_{k,E}(e)=x$.

Combined with the interpretation α of the VP, we get:

(16) $\lambda x \lambda e.\alpha(e) \wedge \boldsymbol{C}_{\alpha}(e)=x$

In context k, this denotes the relation that holds between events e and individuals x if e is in α and $\boldsymbol{C}_{k,\alpha}(e)=x$.

The rest of the semantic derivation follows the lines indicated in section (2) above. The relative clause construction involves a null operator. The trace of this operation is interpreted as free variable x, to which the relative clause interpretation derived so far applies:

(17) $\lambda e.\alpha(e) \wedge \boldsymbol{C}_{\alpha}(e)=x$

Following Kim 2007, G makes event existential closure part of an aspectual operation. For ease of presentation, we ignore the aspectual aspects and reduce the operation to existential closure:

(18) $\exists e[\alpha(e) \wedge \boldsymbol{C}_{\alpha}(e)=x]$

We have derived an interpretation at type t, and at the level of the null operator, we can abstract over variable x, deriving a predicate:

(19) $\lambda x.\exists e[\alpha(e) \wedge \boldsymbol{C}_{\alpha}(e)=x]$

In context k this denotes the set of all objects x such that for some event e in α, x fills the role $\boldsymbol{C}_{k,\alpha}$ of e, where $\boldsymbol{C}_{k,\alpha}$ is a role that is salient in k and defined for e.

The relative clause occurs in argument position. With G, we assume that the definiteness operation derives an argument interpretation:

(20) $\sigma(\lambda x.\exists e[\alpha(e) \wedge \boldsymbol{C}_{\alpha}(e)=x])$

In context k this denotes the sum of all the objects x such that for some event e in α, x fills the role $\boldsymbol{C}_{k,\alpha}$ of e, if that sum is itself an object that fills the role $\boldsymbol{C}_{k,\alpha}$of e, for some event e in α.

3.2. The Induced Relevancy Condition.

Choose role semantics choose in context k a salient role defined for all the events in event type F, normally the VP event type that ChR applies to. As expressed, normally the salient roles are the roles explicitly introduced by the interpretation of the VP. Also, normally these defined roles are thought of as *thematic* roles, roles that have a grammatical role, in that they are associated with verbal arguments, or serve as the interpretation of ad-positions.

However, the formal theory doesn't *require* our roles to be of this nature, and this is a good thing, because it introduces a bit of pragmatic flexibility into the choose role semantics. Look at (21):

(21) a. Irene read a book about Schubert.

b. $\lambda e.READ(e) \wedge Ag(e)=Irene \wedge \exists x[BOOK(x) \wedge Th(e)=x \wedge ABOUT(x,Schubert)]$
The set of all reading events whose agent is Irene and whose theme is a book about Schubert.

Now, obviously, in a normal context k, the roles of Agent and theme are roles defined on the event type and are roles that are salient. But, arguably, in a normal context, books have authors. Look at the function in (22):

(22) $\lambda e.AUTHOR(Th(e))$
The function than maps every event onto the author of its theme (when defined).

This function is a role. It is not defined for many event types, but obviously, it *is* defined in a normal context for all the events in the event type (21b). This means that this role is *in principle* available as a salient defined role, where *in principle* means: if we want it to. The example in (21) figures in well-known examples of discourse anaphora involving *bridging* (cf. Heim 1982 and references therein).

(23) Irene read a book about Schubert and wrote to **the author.**

This means, then, that the choose role semantics developed here can allow the relevant role to be defined indirectly, i.e. retrievable through inference. How much use we want to make of this option is an empirical matter.

How much bridging is allowed in Japanese and Korean internally headed relatives? The following data from Shimoyama 2001 (chapter 3) at first sight suggests that the answer is: none.

(24) a. Dono hosuto$_1$-mo [$_{DP2}$ [$_{DP1}$ **soitu$_1$-no hahaoya**-no] sushi]-o dasite
which host-mo [[his mother-Gen] sushi]-acc served
suguni pro$_1$ home-ta.
immediately praise-past
Every host served his mother's sushi and praised her immediately.

b.#Dono hosuto$_1$-mo [[pro$_1$ [$_{DP2}$ [$_{DP1}$ **soitu$_1$-no hahaoya**-no] sushi]-o dasita]-no]-o
which host-mo [[[[his mother-Gen] sushi]-acc served]-no-acc
suguni home-ta.
immediately praise-past
'Every host served his mother's sushi and praised her immediately.

The discourse in (24a) allows *his mother* to function as a discourse anaphor and be praised even though not she, but her sushi is part of the serving events. (24b) with an internally headed relative seems not to allow this option.

Shimoyama regards this contrast as 'rather puzzling' (as well she might in a discourse anaphora analysis of internally headed relatives), and suggests that 'only thematic role bearers of the event in the lower clause can be the internal head.'

However, it is not the case that genitive possessors in general are unable to function as internal heads, as shown by the data in (25), kindly provided by Koji Hoshi (p.c.), who rated this example as fully acceptable.

(25) [[Dono otokonohito$_1$-mo [$_{DP2}$ [$_{DP1}$ [daidokoro-no] **zibun$_1$-no] tuma$_2$**]-no
which man-mo [[kitchen-gen] self-gen] wife]-gen
sushi]-o kyaku-ni dasita]-no]-o kyaku-ga suguni
sushi]-acc guest-dat served]-comp]-acc guest-nom immediately
yon-de home-ta.
call-and praise-past
'Every man served to the guest the sushi of his wife, who was in the kitchen, and the guest called and praised her immediately after that.'

The distinction between (24b) and (25) shows that Japanese is not *very* free in what kind of bridging is allowed in the choose role mechanism: while in the relevant event type in (24b) the role of being the mother of the man and the maker of the sushi is defined for the relevant events (in the context), this is not apparently enough. The only difference seems to be that in (25), the wife and sushi maker is spatio-temporally hooked to the serving events in question, put, so to speak, on the scene, and that, it seems, is just enough. (What helps, too, is that in (25) it unambiguously the wife who is praised, while (24b) allows an interpretation where it is actually the sushi that is praised, leaving the relation indirect.)

Kuroda 1976-77 observed that internally headed relative clauses obey what he called the Relevancy Condition (formulation adapted from Kuroda 1992).

(26) a. *The Relevancy Condition*
For an internally headed relative to be acceptable, it is necessary that it be interpreted pragmatically in such a way as to be directly relevant to the pragmatic content of its matrix clause.
b. *Sub-condition:*
The two events represented by the internally headed relative and the matrix clause involve the same temporal interval and the same location.

Kim 2007 pointed to the need to refine the above sub-condition by allowing it to be satisfied by a state resulting from the event described by the relative, and by incorporating into it a suggestion made by Shimoyama 2001, Chapter 3 to the effect that the two event(ualities) need to share a thematic participant. G further showed that both Kuroda's sub-condition and Kim's refinement of it are inadequate in being unable to deal with constructions that involve a participant in an eventuality associated with a clause embedded within the relative. G proposed a new sub-condition (see his (37)), which we slightly reformulate below:

b'. *Revised Sub-condition*
The event in which the denotation of the internal head is a participant, or some state resulting from this event, must temporally, spatially, and modally intersect with the event described by the matrix clause.

The Relevancy Condition, in particular, its sub-condition, is yet another way in which internally headed relatives differ from discourse anaphora constructions (for illustration, see G's examples in his (9) and the text surrounding them).

What is important for our purposes here is that the Relevancy Condition *constrains* the choose role mechanism. The Revised sub-condition expresses the requirement that there must be temporal and spatial overlap between the event type that the choose role mechanism applies to and the event type of the matrix, or a connection between the two via a stable result state (by which we mean a result state that is temporally and spatially unexciting, i.e. one that does not, e.g, change its location in pragmatically dramatic ways).

The role selected by the choose role mechanism enters into the formation of the predicate and the definite argument in the matrix. The denotation of this definite is a (possibly distributive) participant of the matrix event type. Obviously, it will *help* the Relevance Condition to be satisfied, if the role selected by the Choose Role mechanism is a role which maps each event e in the input event type onto an object that is a participant in some (pragmatically salient) event that temporally and spatially overlaps with e (or onto a participant in an appropriate stable result state). This does not by itself enforce the Relevancy Condition, but it *does* help to put these objects 'on the scene' (and that is all we need for the examples discussed here).

We propose the following constraint on the choose role mechanism.

(27) *Induced Relevancy Condition:*
For a role R, defined on event type F to be salient it must satisfy the Induced Relevancy Condition for F.
R *satisfies the Induced Relevancy Condition* for F iff for every $e \in F$: R(e) is a participant in a salient event which intersects temporally, spatially, and modally with e or in some stable state resulting from e.

With the Induced Relevancy Condition, the difference between (24) and (25) can be accounted for: (24b) involves the function that maps each event e of a host serving sushi onto the person who is his mother and made the sushi. The context does not put the mother of the host on the scene of e, i.e. it does not provide an event e in which the host's

mother participates that is simultaneous with e and at the same (rough) location. In (25), the context allows a construction of the relevant role as a function that maps each serving event e onto the person who is the wife of the host, made the sushi, and is the participant of an event of busying herself in the kitchen simultaneous to e at the same (rough) location as e.

Bridging via a stable result state is found in examples like the full version of (28), kindly provided by Koji Hoshi (p.c.) (the reduced version is example (10) in Hoshi 1995, p. 121):

(28) John-wa [Mary-ga (gozentyuu-ni) ringo-o sibottekureta-no]-o
John-top [Mary-nom (in-the-morning) apple-ac squeezed-no]-acc
(gogo-ni) hitoikide nomihosita.
in-the-afternoon in-a-gulp drank-up
'Mary squeezed apples (in the morning), and John drank it [= the juice produced by squeezing the apples] in a gulp (in the afternoon).'

In this case, the function that maps the squeezing apple events onto the juice squeezed out in this way is not directly a role in the squeezing event type, but it maps the event onto a participant of a result state of the juice being stably in a container at a place where John can get it in order to engage in the afternoon's gulping event.

Very much the same happens in example (29b) (Kim's (18)):

(29) a. Paci-ka teleweci-ess-ta. #John-un kukes-ul takkanayssta. (Kim's 17)
Pants-nom get.dirty-pst-decl. #John-top it-acc wiped.out
'The pants got dirty. #John wiped **it** (=the dirt) off.'
b. ?John-un [[paci-ka teleweci-∅]-un kes]-ul takkanayssta. (Kim's 18)
John-top [[pants-nom get.dirty-prf]-rel kes]-acc wiped.out
'The pants got dirty and John wiped the dirt off the pants.'
(adapted from Chung and Kim 2003: ex. (40))

In this example, the discourse anaphora case is, according to Kim, infelicitous (see (29a)). The internally headed relative is much better (see (29b)). For us, the two phenomena may be related, but are not the same. (29b) involves the selection of a defined salient role by the choose role semantics that has to satisfy the Induced Relevancy Condition: bridging is only possible if the role in question puts for each event the value of the role so to say 'on the scene' of the event (again, through a stable result state). Thus, (29b) is much like Hoshi's (28).

As far as the infelicity of (29a) (which exhibits a discourse anaphor) is concerned, we point out that (29a), unlike (29b), uses an overt pronoun. Koji Hoshi (p.c.) kindly informs us that data parallel to (29) can be constructed in Japanese, offering the examples in (30). He points out, though, that the infelicity of (30a) largely disappears (for him) if a null pronoun is used instead of *sore* 'it' (as in (30c)):

(30) a. Zubon-ga yogoretesimatta. (Sorede,) #John-wa sore-o hukitotta.
Pants-nom get-dirty-past (So) John-top it-acc wiped-out
The pants got dirty. Intended: John wiped it (= the dirt) off.
b. ?John-wa [[zubon-ga yogoretesimatta]-no]-o hukitotta.
John-top [[pants-nom get-dirty-past]-no]-acc wiped out
'The pants got dirty and John wiped the dirt off the pants.'
c. Zubon-ga yogoretesimatta. (Sorede,) John-wa hukitotta.
Pants-nom get-dirty-past (So) John-top wiped-out
'The pants got dirty. Intended: John wiped it (= the dirt) off.'

If Hoshi is right, then infelicity in (29a) and (30a) is due to a constraint on the explicit discourse pronoun.

In sum, bridging in explicit discourse pronouns may well be more restricted than bridging in null discourse pronouns (as suggested by the examples in (29) and (30)) or internally headed relatives; bridging in null discourse pronouns may well be less restricted than bridging in internally headed relatives (as suggested by the examples in (24)). On our analysis of internally headed relatives, the choose role semantics involves the contextual selection of a salient role defined on the relevant event type satisfying the Induced Relevancy Condition. Discourse anaphora involves the contextual selection of a property to construe the appropriate interpretation of the anaphor. This may be done via the construction of a role on a contextually given event type (i.e. similar to the choose role mechanism), but it may also be done more contextually. On our analysis, then, it is not a surprise if the two phenomena – choose role and discourse anaphora - are similar, but neither is it a surprise if the latter phenomenon is possible in contexts which allow a more indirect bridging relation, because, after all, the two phenomena are, on our account, not the same.

In keeping with these results, we expect to find differences between discourse anaphora and internally headed relative clauses in terms of accommodation: many types of accommodation that are possible for discourse anaphora constructions are not possible in internally headed relatives, because the role selected cannot simultaneously satisfy the bridging condition and map onto events involving the accommodated element. For illustration, see G's discussion of his examples in (6) (and some of the examples in the next section).

3.3. A note on negation.

Negation in the relative clause is of interest in the present context under at least two distinct circumstances: when it is interpreted as semantic negation, and when it constitutes a mere dummy without which certain types of nominals are uninterpretable. In both situations, internally headed relatives behave differently from discourse anaphora, but the two phenomena are distinct, and required different explanations.

Hoshi 1995, section 3.3.3 provides the following examples with semantically interpreted negation (= his (31) and (32), with inconsequential adaptations).

(31) *John-wa [Mary-ga teeburu-no ue-ni ringo-o oitekurenakatta-
John-Top [Mary-Nom table-Gen on apple-Acc did-**not**-put
no]-o totte tabeta.
no]-Acc picked up and ate
'*Mary put no apples on the table, and John picked them up and ate them.'

(32) *John-wa [Mary-ga orenzi-o siboranakatta no]-o nomitagatteiru.
John-Top [Mary-Nom orange-Acc did-**not**-squeeze no]-Acc want-to-drink
'*Mary did not squeeze oranges, and John wants to drink the orange juice.'

These examples are unsurprisingly incoherent, since comparable discourses, in particular, their fluent English translations, are incoherent in the same way. In the discourses, a definite anaphor, which presupposes the existence of a unique entity, purports to take as antecedent a non-existent entity.

What makes such data interesting in the present context is that the discourse counterparts of data like (31)-(32) can be salvaged by accommodation, but the corresponding internally headed relatives cannot. To see this, consider the following data, obtained by slightly modifying G's examples (6): The verb of the first sentence in (33a) and of the relative clause in (33b) is negated, and G's antecedent/internal head is replaced by a polarity item. While (33a) easily receives a reasonable accommodated interpretation, (33b) is incoherent, just like as (31)-(32), and for the same reason.

(33) a. **Hitorino insei-mo** doyoobi-no party-ni ikanakatta.
no grad-student Saturday-Gen party-to go-**Neg**-Past
Karera-wa jitsuwa uchi-de term paper-o kaite ita.
they-Top in-fact home-at term paper-Acc writing was
'No graduate student(s) came to the party on Saturday. They (i.e., the students) were in fact writing term papers at home.'

b. *[[**Hitorino insei-mo** doyoobi-no party-ni ikanakatta]-no]-ga
[[no grad-student Saturday-Gen party-to go-**Neg**-Past]-no]-Nom
jitsuwa uchi-de term paper-o kaite ita.
in-fact home-at term paper-Acc writing was
'*No graduate student(s) came to the party on Saturday, they (i.e., the non-existent students at the party) were in fact writing term papers at home.

The infelicity of (33b) with an internally headed relative is expected on the choose role semantic analysis. The functional category ChR is attached higher than the negation. In event semantics, negation does not semantically enter into the event type, but requires the event type to be semantically closed off by event existential closure (see Landman 2000 for discussion). This means that the semantic interpretation of ChR does not have an event type to operate on, and the interpretation comes to a halt.

Turning now to data that exhibit dummy negation, consider (34a) (=G's (4a)) and its discourse counterpart (34b).

(34) a. #[[**Honno suunin-no insee-sika** doyoobi-no party-ni ikanakatta]-no]-ga
[[just a-few-Gen grad-student-sika Saturday-Gen party-to go-**Neg**-Past]-no]-nom
sono-party-o tanoshinda.
that-party-Acc enjoyed
'Only a few graduate students came to the party on Saturday, and they enjoyed the party.'

b. **Honno suunin-no insee-sika** doyoobi-no party-ni ikanakatta.
just a-few-Gen grad-student-sika Saturday-Gen party-to go-**Neg**-Past
Karera-wa sono-party-o tanoshinda.
they-Top that-party-Acc enjoyed
'Only a few graduate students came to the party on Saturday. They enjoyed the party.'

While the facts in (34) bring out a contrast between discourse and internally headed relatives, they differ from those in (31)-(33) in a number of important ways. First, the discourse version is perfectly acceptable without any appeal to accommodation. Second, the relative in (34a) and the first sentence in (34b) are affirmative, the negative morphology on the verb having no other function than to license the item *sika,* which is uninterpretable in isolation, and receives a meaning only in combination with dummy negation. Third, while the internally headed relatives in (31)-(33) are, as far as we can tell, incoherent for all speakers of Japanese (much as the discourse counterparts of (31) are incoherent in all the languages we know), the deviance of data like (34a) is idiolect-specific. Thus, while G's consultants and one of his referees found such data ill-formed, Koji Hoshi (p.c.) kindly informs us that he finds data like (34a) essentially acceptable, and data like (35) absurd, but not ill-formed. We note that Shimoyama 2001, Chapter 3, who brought up (35) as an illustration of the unavailability of accommodation in internally headed relatives, also rated it as absurd, but not ill-formed.

(35) #[[**Honno suunin-no insee-sika** doyoobi-no party-ni ikanakatta]-no]-ga
[[just a-few-Gen grad-student-sika Saturday-Gen party-to go-**Neg]**-Past-no]-nom
jitsuwa uchi-de term paper-o kaite ita.
in-fact home-at term paper-Acc writing was
'#Only a few graduate students came to the party on Saturday, and they (= those very students) were in fact writing term papers at home.'

In sum, the inability of nominals that include *sika* to function as internal heads is a Japanese-specific, idiolectically restricted phenomenon, which does not generalize to comparable discourses cross-linguistically. We surmise that this phenomenon is traceable to the fact that the application of ChR to the VP of the relative in data like (34a) and (35) yields an output that is ill-formed until negation is encountered. It seems that for some speakers, the derivation blocks at this stage, while for others, it may conditionally proceed, rejection taking place just in case a licensing token of dummy negation fails to be encountered. We leave it open whether the different acceptability judgments stem

from a difference in the internal grammars of speakers, or from a difference in the ways in which they process sentences.[1]

4. Choose role semantics and cumulative event types

The choose role semantics reopens a role that was filled at the level of the VP and abstracts over the individual value of that role. What we mean by this is the following.

Think of externally-headed relatives: the trace of the relativization operation fills an argument position introduced by the verb or an adjunct inside the VP. This position is syntactically realized as a gap, and the corresponding role is semantically filled by a variable that is abstracted over at the level where the relativization operation is realized.

In Japanese/Korean internally-headed relatives, there is no such argument position available inside the relative: all such positions are lexically filled as in a normal indicative. What ChR does is introduce (via the operator in its Spec) a syntactic gap: the trace of the operator. Semantically, ChR takes a role that was already semantically filled at the level of the VP, and abstracts over its value, creating a semantic predicate which looks like a verb interpretation with the role corresponding to one of its argument positions not yet filled. Semantically, then, the individual variable corresponding to the trace of the null operator serves as argument of this (derived) predicate, and thereby becomes the value of the reopened role, just as it would have become the value of that

[1]Referee A observed that the values of roles selected by ChR are not free to exhibit just any quantificational force. This referee provided an example in which existentially quantified internal heads were rated acceptable, while definite nominals and nominals exhibiting the quantifier *subete* (which this referee glosses as 'every') were rated unacceptable. Since the referee made no reference to internal heads with *hotondo* 'almost all' as in our example (53), we assume (s)he found such data acceptable.

A brief check we conducted with all our Japanese and Korean consultants revealed that this phenomenon also involves some cross-idiolectal variation. By and large, all the consultants that accepted internally-headed relative in the first place accept existentially quantified internal heads. The overwhelming majority also accepted internal heads with *hotondo* or the roughly equivalent Korean item *taipwupwun,* except for Jae-Il Yeom, who rejected such data. Concerning data with internal heads with *subete,* all our consultants accepted them, but Akira Watanabe (p.c.) pointed out that this item is compatible with mass nouns, and is thus more appropriately glossed as 'all.' In contrast, nominals of the form *dono NOUN-mo* are incompatible with mass nouns, are adequately glossed as 'every', and were judged unacceptable by our consultants. Finally, data with definite internal heads were generally felt to be degraded, except in situations where the apparent relative constructions are also interpretable as adverbials (on this point, see Shimoyama 2001, Chapter 3, section 3.5.3).

We believe the above preferences for certain types of internal heads is amenable to systematic explanation, but going further into this matter in this paper would take us too far afield, and we thus leave the more detailed consideration of such facts for another occasion.

role, had it, rather than the argument specified inside the VP, semantically combined with the interpretation of the verb.

Thus, on our analysis, Japanese/Korean internally-headed relatives are really relative clauses. They use the very same mechanism of relativization as externally-headed relatives:

> Relativization forms a syntactic and semantic predicate, an operator-gap construction that abstracts over a variable that fills a semantic role inside the relative.

Japanese/Korean internally-headed relatives and externally-headed relatives differ in how the gap is introduced and associated with the semantic role: in externally-headed relatives the gap is introduced directly into the VP syntactic structure and the gap replaces a lexically realized argument that would have occurred in that position, had the structure not been a relative. Semantically, the variable just fills the role a lexically realized argument would have filled.

In Japanese/Korean internally-headed relatives, all the arguments inside the VP are filled, and so are, semantically, the corresponding roles. But ChR can introduce another position for relativization to work on, and semantically, one of the roles is reopened, and hence can be filled after all with the variable corresponding to the gap.

The relativization mechanism explains the island sensitivity effects that are found with internally-headed relatives (as discussed in G). The remainder of the semantics is in essence existential closure, abstraction (predicate formation), and definiteness. The similarities to discourse anaphora follow by and large from the fact that discourse anaphora require the contextual reconstruction of a property to satisfy the definiteness requirement of the anaphor. The natural place to look for the relevant property is in the event type corresponding to the VP in the previous discourse. With that, the construction of the relevant property is likely to mimic what the grammar does in Japanese/Korean internally-headed relatives.

So far so good. But do we get the *correct* semantics in this way? Interestingly enough, the answer is that we do, but *only* if we allow a mechanism whereby the noun phrase arguments of a relation contribute *directly* at the level of the event type of the relation only scopeless interpretations, whereas their scope-sensitive properties, and even scopal relations, are contributed *indirectly*, adverbially, to the event type of the relation.

Thus, the standard mechanisms for creating scopal dependencies (like quantifying-in or QR) interact with the *choose role* mechanism with detrimental effects, giving wrong readings for examples where the internal head is in the scope of a quantifier. We show this in section 4.6, the section where we discuss the most challenging examples for the analysis of internally-headed relatives: cases where the internal head is in the scope of a universal quantifier.

It seems plausible to assume that the presence of ChR blocks the application of the standard external scope mechanisms. This is relevant in Japanese, even though it is well known that Japanese does not in general allow inverse scope readings. Quantificational and negative quantifiers cannot get their interpretation directly at the level of the event type of the relation: they must take scope over the event existential quantifier (or, if possible, take scope by an adverbial scope mechanism). This is

independent of whether or not inverse scope readings are allowed, and also of the fact that certain potentially problematic forms of quantification (e.g., the downward entailing variety, for most speakers) are independently excluded as internal heads (see G's example (4) and the discussion thereof on pp. 235-6).

If the external scope mechanism is blocked, scopal relations can only be gotten by an internal scope mechanism, i.e. a mechanism of scopeless (cumulative) interpretations with scopal properties and relations added locally, adverbially to the event type.

This means, then, that the semantics of Japanese/Korean internally-headed relatives provides evidence for the family of theories of cumulative readings that separate the scopal and non-scopal aspects of the interpretation of the noun phrase arguments of a relation, and allow scopal properties and relations be added independently and locally, i.e. theories like Schein 1993, Krifka 1999, Landman 1998, 2000, and others. We will show this by discussing a number of examples.

4.1. *At least three cookies*

(36) Taro-wa [$_{CP}$Yoko-ga reezooko-ni **kukkii-o sukunakutomo mit-tsu**
Taro-Top Yoko-Nom refrigerator-Loc **cookie-acc at least three-cl**
irete-oita]-no-o paatii-ni motte itta.
put-aux-no-acc party-to brought
'Yoko put **at least three cookies** in the refrigerator and Taro brought **them** to the party.'

This is the simplest kind of example, with an upward entailing argument *at least three cookies*. We can give the VP inside the relative clause the following interpretation:

(37) $\lambda e.\text{PUT}(e) \wedge \text{Ag}(e)=\text{Yoko} \wedge \text{Th}(e) \in {}^*\text{COOKIE} \wedge |\text{Th}(e)| \geq 3 \wedge \text{Into}(e)=\sigma(\text{FRIDGE})$
The set of (sums of) putting-into-the-fridge events e with Yoko as agent and sums of at least three cookies as theme.

ChR forms the following interpretation:

(38) $\lambda x.\lambda e.(37)(e) \wedge \boldsymbol{C}_{(37)}(e)=x$

In context k, $\boldsymbol{C}_{k,(37)}$ will choose a role from $\mathbf{SR}_{k,(37),}$, a salient role defined for all events in (37). The relevant roles here are the (plural) roles Ag, Th, Into. Since these roles map events onto participants of these events, they obviously satisfy the Induced Relevancy Condition.

Here we assume that in context k $\boldsymbol{C}_{k,(37)}$ = Th. This means that we can derive:

(39) $\lambda x.\lambda e.(37)(e) \wedge \text{Th}(e)=x$ (in context k)

This is:

(40) λxλe.PUT(e) ∧ Ag(e)=Yoko ∧ Th(e)∈*COOKIE ∧ |Th(e)|≥3
∧ Into(e)= σ(FR) ∧ Th(e)=x

We apply this function to the interpretation of the null operator trace x, do event existential closure, abstract over x and get a predicate in (41) and a definite in (42):

(41) λx.∃e[PUT(e) ∧ Ag(e)=Yoko ∧ Th(e)∈*COOKIE ∧ |Th(e)|≥3
∧ Into(e)= σ(FR) ∧ Th(e)=x]

The set of sums of at least three cookies, for which there is a putting-in-the-fridge event with Yoko as agent, and that sum as theme.

(42) σ(λx.∃e[PUT(e) ∧ Ag(e)=Yoko ∧ Th(e)∈*COOKIE ∧ |Th(e)|≥3
∧ Into(e)= σ(FR) ∧ Th(e)=x])

For the definite (42) to be defined, (41) should be not empty – i.e. it is presupposed that Yoko *did* put at least three cookies in the fridge – and the sum of all the objects in (41) should itself be an object in (41). This means that the sum of all the sums of at least three cookies that Yoko put in the fridge should itself be a sum of at least three cookies that Yoko put in the fridge. This is obviously the case.

This means that the definiteness operation in (42) is defined and (42) is (43a), presupposing (43b):

(43) a. The sum of all the cookies that Yoko put in the fridge.
b. Yoko put at least three cookies in the fridge.

4.2. *Two thieves.*

(44) Anthony-wa [**dorobou-ga futa-ri** nige-teiru-no]-o tsukamae-ta.
Anthony-top **thief-nom** **two-cl** run.away-prog-no-acc catch-past

Two thieves were running away, and Anthony caught **them**.

This second example illustrates very well the similarity to discourse anaphora.
The interpretation of the VP in the relative clause is:

(45) λe.RUN(e) ∧ Ag(e) ∈ *THIEF ∧ |Ag(e)|=2
The set of running events whose agent is a sum of two thieves.

The events in the event type (45) are compatible with there being more thieves that ran away. As usual, in a normal context, there is an implicature that not more than two thieves ran way.

With ChR we form:

(46) $\lambda x.\lambda e.(45)(e) \wedge \boldsymbol{C}_{(45)}(e)=x$

We assume that in context k, $\boldsymbol{C}_{k,(45)}$ = Ag, and we derive the relative clause property (47) and the definite expression (48):

(47) $\lambda x.\exists e[RUN(e) \wedge Ag(e) \in *THIEF \wedge |Ag(e)|=2 \wedge Ag(e)=x]$

The set of sums of two thieves, for which there is a running away event with that sum as agent.

(48) $\sigma(\lambda x.\exists e[RUN(e) \wedge Ag(e) \in *THIEF \wedge |Ag(e)|=2 \wedge Ag(e)=x])$

The definite in (48) relies on the implicature mentioned. For the definite to be defined in (48), the set in (47) must contain the sum of all the sums of two thieves that ran away. This means that the sum of all the sums of two thieves that ran away is required to be itself a sum of two thieves that ran away, which is, of course, what the implicature says.

Relying on the implicature, in context k (47) has a singleton interpretation and denotes (49b), and the definite denotes (49c):

(49) a. Not more than two thieves ran away.
b. $\{t_1 \sqcup t_2\}$, where t_1 and t_2 are the thieves in question.
c. $t_1 \sqcup t_2$.

The implicature can be canceled in the kind of contexts that Kadmon 1990 discussed, like the example in (50):

(50) Anthony-wa [**dorobou-ga futa-ri** nige-teiru-no]-o tsukamae-ta.
Anthony-top **thief-nom** **two-cl** run.away-prog-no-acc catch-past
Shikashi **san-nin-me-no** **dorobou-mo** nige-teite Anthony-wa kare-o
but **three-cl-th-gen thief-also** run.away-prog Anthony-top he-acc
tsukamae-ru koto-ga deki-nakat-ta.
catch-non.past thing-nom be.able-neg-past
'Two thieves were running away, and Anthony caught **them**. But **a third thief** was also running away, and Anthony did not manage to catch him.

In a natural context for this example, the implicature in (49a) is canceled. Instead of (49b) we have (49b') as the denotation of (47):

(49) b'. $\{t_1 \sqcup t_2, t_1 \sqcup t_3, t_2 \sqcup t_3\}$, where t_1, t_2, t_3 are the thieves in question.

In this case the definite in (48) is undefined, because $\sqcup(\{t_1 \sqcup t_2, t_1 \sqcup t_3, t_2 \sqcup t_3\}) = t_1 \sqcup t_2 \sqcup t_3$, which is not in (49b').

What happens in this case is what Kadmon assumes happens in similar cases of discourse anaphora: the context provides a contextually salient property or relation. For instance, in the present example, a natural contextual restriction could be the interpretation of *ran away* as: *ran away in the direction of where Anthony stood*.

We assume a contextually restricted interpretation of the VP:

(51) $\lambda e.RUN(e) \wedge Ag(e) \in *THIEF \wedge |Ag(e)|=2 \wedge Dir(e,loc(Anthony))$

The set of running events whose agent is a sum of two thieves and whose direction is towards the location of Anthony.

With this contextual reinterpretation, the reinterpreted implicature is (52), the reinterpreted relative clause denotes *as before*, (49b), and the definite has the same interpretation as before, (49c):

(52) Not more than two thieves ran away in the direction of Anthony
(49) b. $\{t_1 \sqcup t_2\}$, where t_1 and t_2 are the thieves in question
(49) c. $t_1 \sqcup t_2$.

4.3. *Almost all cookies*

(53) a. Taro-wa [$_{CP}$Yoko-ga reezooko-ni **kukkii-o** **hotondo** irete-oita]-no-o
Taro-Top Yoko-Nom refrigerator-Loc **cookie-acc** **almost-all** put-aux-no-acc
paatii-ni motte itta.
party-to brought
''Yoko put **almost all the cookies** in the refrigerator and Taro brought **them** to the party.'

Our consultants tell us that (53) expresses that Yoko did not put all the cookies in the fridge (which is generally assumed to hold as well of *almost all* in English, e.g. Sevi 1998). G followed Shimoyama in assuming that *kukkii-o hotondo* means *most cookies*, which does not have this entailment. We modify G's account to incorporate this.

Let us assume that context k determines, for property P, a number $\mathbf{f}_{k,\sqcup(*P)}$ which gives us the upper bound for what counts as *few Ps* in context k.

We add to the logical language an expression $\mathbf{few}_P$ which in context k denotes $\mathbf{f}_{k,\sqcup(*P)}$.

Thus, in context k, $\mathbf{few}_{COOKIE}$ denotes $\mathbf{f}_{k,\sqcup(*COOKIE)}$, the number below which a number of cookies counts in k as few cookies. We assume the following event type:

(54) $\lambda e.PUT(e) \wedge Ag(e)=Yoko \wedge Th(e) \in *COOKIE \wedge Into(e)=\sigma(FR) \wedge$
$\exists n[0 < n < \mathbf{few}_{COOKIE}:|Th(e)| = |\sqcup(*COOKIE))| - n]$

The set of events e of Yoko putting a sum of cookies in the fridge which is almost, but not quite, the sum of all cookies: i.e. its cardinality is the cardinality of the sum of all cookies*, minus a positive number that counts as few (in context k).* The fact that the number in question is positive means that indeed, it is not all cookies.

With ChR we form:

(55) $\lambda x.\lambda e.(54)(e) \wedge \boldsymbol{C}_{(54)}(e)=x$

We assume that in context k, $\boldsymbol{C}_{k,(54)}$ = Th, and we derive for the relative clause property (56), and for the definite expression, (57):

(56) $\lambda x.\exists e[PUT(e) \wedge Ag(e)=Yoko \wedge Th(e) \in *COOKIE \wedge Th(e)=x \wedge Into(e)=\sigma(FR) \wedge \exists n[0 < n < \mathbf{few}_{\sqcup(*COOKIE)}:|Th(e)| = |\sqcup(*COOKIE))| - n]]$

(57) $\sigma(\lambda x.\exists e[PUT(e) \wedge Ag(e)=Yoko \wedge Th(e) \in *COOKIE \wedge Th(e)=x \wedge Into(e)=\sigma(FR) \wedge \exists n[0 < n < \mathbf{few}_{\sqcup(*COOKIE)}:|Th(e)| = |\sqcup(*COOKIE))| - n]])$

Now, (57) is only defined if (56) contains a maximal element. Let us assume that Yoko put all cookies in the fridge. In that case, (56) will *not* contain a maximal element. An event of Yoko putting the sum of all cookies in the fridge cannot itself be in (56), since in that case n=0, and n is explicitly required to be positive. But then, for any atomic cookie c, there is going to be an event of Yoko putting $\sqcup(*COOKIE)-c$ in the fridge, and that event is going to be in (56). This means that if Yoko put all cookies in the fridge, (56) does not have a maximal element, and (56) is undefined. Thus, the semantics of (57) requires it to be true that Yoko put not all cookies in the fridge.

Now, the maximal element in (57) is the sum of all sums of cookies for which there is an event of Yoko putting them into the fridge and that sum being almost but not quite all cookies. And that sum itself, has to be a sum of cookies that Yoko put in the fridge which is almost, but not quite the sum of all cookies. Clearly, the sum in question is *the sum of all cookies that Yoko put in the fridge, on the condition that this sum is not the sum of all cookies, but the sum of all cookies except for a few.*

4.4. *Exactly three students.*

(58) [[**Tyoodo san nin-no insei-ga** doyooobi-no party-ni kita]-no]-ga
Exactly three **grad-students** Saturday-Gen partu-to go-Past-no-Nom
sono-party-o tanoshinda
that-part-Acc enjoyed
'Exactly three graduate students came to the party on Saturday, and **they** enjoyed the party.'

In this case, we need to deal with the semantic effect of *exactly three* in the VP semantics. If we analyze (58) along the lines of (44), with just the meaning of *three students*, we get the event type (59):

(59) $\lambda e.GO(e) \wedge Ag(e) \in *STUDENT \wedge |Ag(e)|=3 \wedge To(e) = \sigma(PARTY)$

The set of going to the party events with a sum of three graduate students as agent.

The problem is that each event in (59) is compatible with there existing an event of more graduate students going to the party. This means that existential closure over the event argument is going to produce a meaning which is wrong for the relative clause in

(58) (while similar existential closure over the event argument would arguably not be wrong for the comparable case of (44)). Thus, we must somehow get (58) to express the *exactly* meaning semantically.

Krifka 1999 and Landman 1998 propose, in the context of the discussion of cumulative readings, that in fact the meaning of *exactly three graduate students* makes two separate contributions to the event type of the VP. In the first place, it provides as the agent argument of the VP the same interpretation that *three graduate students* does. But secondly, it adds the *exactly* meaning *separately* to the event type.
This means that we can regard the event type for (60a) as a scopeless conjunction of independent statements:

(60) a. Exactly three students danced with exactly four professors
b. $\lambda e.DANCE(e) \wedge Ag(e) \in$ three students $\wedge$ Th(e) $\in$ four professors
$\wedge$ e involves all students that danced with a professor
$\wedge$ e involves all professors that a student danced with

For our example, this analysis comes down to analyzing (61a) along the lines of (61b):

(61) a. Exactly three graduate students came to the party
b. Three graduate students came to the party, *exactly three*.

We give here an analysis that is good enough for illustrative purposes. For a systematic treatment, see e.g. Landman 2000. The event type without the *exactly* meaning is (62):

(62) $\lambda e.GO(e) \wedge Ag(e) \in$ *STUDENT $\wedge$ |Ag(e)|=3 $\wedge$ To(e) = σ(PARTY)
The set of going to the party events with a sum of three graduate students as agent.

The relevant *exactly* meaning is (63) (maximalization on the agent role):

(63) $\lambda e.Ag(e) = Ag(\sqcup(\lambda e.GO(e) \wedge Ag(e) \in$ *STUDENT $\wedge$ To(e)= σ(PARTY))
The set of events whose agent is the agent of the sum of all the events of graduate students going to the party.

The two together give (64):

(64) $\lambda e.GO(e) \wedge Ag(e) \in$ *STUDENT $\wedge$ |Ag(e)|=3 $\wedge$ To(e) = σ(PARTY) $\wedge$
$Ag(e) = Ag(\sqcup(\lambda e.GO(e) \wedge Ag(e) \in$ *STUDENT $\wedge$ To(e) = σ(PARTY))
The set of going to the party events with a sum of three graduate students as agent, whose agent is the agent of the sum of all the events of graduate students going to the party.

With ChR we form:

(65) $\lambda x.\lambda e.(64)(e) \wedge \boldsymbol{C}_{(64)}(e)=x$

We assume that in context k, $\boldsymbol{C}_{k,(64)}$ = Ag, and we derive for the relative clause property (66) and the definite expression (67):

(66) $\lambda x.\exists e[GO(e) \wedge Ag(e)\in *STUDENT \wedge |Ag(e)|=3 \wedge To(e)=\sigma(PARTY) \wedge Ag(e)=x \wedge Ag(e) = Ag(\sqcup(\lambda e.GO(e) \wedge Ag(e)\in *STUDENT \wedge To(e)=\sigma(PARTY)]$

(67) $\sigma(\lambda x.\exists e[GO(e) \wedge Ag(e)\in *STUDENT \wedge |Ag(e)|=3 \wedge To(e)=\sigma(PARTY) \wedge Ag(e)=x \wedge Ag(e) = Ag(\sqcup(\lambda e.GO(e) \wedge Ag(e)\in *STUDENT \wedge To(e)= \sigma(PARTY)])$

(66) denotes the set of objects x such that for some sum of going to the party events e, x is the agent of e, x is a sum of three students, and x is the agent of the sum of all going to the party events with students as agent. This means that (66) denotes the singleton set (68a), and the definite is defined and denotes (68b):

(68) a. $\{s_1 \sqcup s_2 \sqcup s_3\}$ for s_1, s_2, s_3 the three students who went to the party.
b. $s_1 \sqcup s_2 \sqcup s_3$.

4.5. *Three children each two apples*

(69) Wasaburo-wa [*3-nin-no kodomo-ga sorezore ringo-o* ***2-tu-zutu*** katte-kita]-no-o
Wasabura-Top 3-Cl-Gen *children-Nom each* ***apple-Acc 2-Cl***-each buy-came-no-Acc
tana-ni oita
shelf-on put
'*Three children bought* ***two apples*** *each* and Wasaburo put ***them*** on the shelf.'

What characterizes this example is that the numeral on the internal head is construed as dependent on a distributive construal of the subject of the relative, with the result that Wasaburo is understood to have put **six** apples on the shelf. For completeness, we note that the numeral on the object, but not the one on the subject, is 'floated', but as Koji Hoshi (p.c.) kindly informs us, this fact is of no relevance to the intended reading, which can be obtained with any of the four logical combinatorial possibilities of [+/-Float] on the subject and object.

Landman 2000 discusses a similar case:

(70) a. Two students gave four professors three flowers.
b. Two students gave four professors *three flowers* ***each***
c. Two students gave four professors *three flowers* ***per professor***

(70a), on one of its interpretations, has a reading which can be expressed as (70c). The interesting thing about this reading is that it is cumulative (scopeless) with respect to the students and the professors: the total number of students involved is two, the total number of professors involved is four, but *three flowers* is interpreted as dependent on the professors. Landman 2000 assumes that the proper way to deal with this case is through dependency relations, which are added adverbially to the event type.

Adverbial quantification has of course been studied extensively, e.g. the volumes of Bach, Jelinek, Kratzer and Partee 1995. But we are concerned here with cases where part of the meaning of what are clearly *argument* noun phrases is analyzed as being contributed through semantic adjunction. The existence of such readings and the need for mechanisms with local scope has been argued extensively, and compositional analyses have been provided for them (see discussion in e.g. Schein 1993, Krifka 1999, Landman 2000, 2004, and more recently Dotlacil 2009, Shimada 2009, Champollion 2010, among many others). Note that we do not propose to eliminate the standard scope mechanism from the grammar, we assume that the literature on plurality has shown ample reason to assume the existence of local scope mechanisms besides the standard mechanism, and we propose that the relevant readings of the VP in cases like (69) are derived by a local scope mechanism.

With this, we assume that the VP in (70) has the following interpretation:

(71) $\lambda e.\mathrm{GIVE}(e) \wedge \mathrm{Ag}(e) \in {}^*\mathrm{STUDENT} \wedge |\mathrm{Ag}(e)|=2 \wedge \mathrm{Go}(e) \in {}^*\mathrm{PROF} \wedge |\mathrm{Go}(e)|=4$
$\wedge\ \mathrm{Th}(e) \in {}^*\mathrm{FLOWER}$
$\wedge\ \forall a \in \mathrm{ATOM}(\mathrm{Go}(e)): \exists e' \sqsubseteq e: \mathrm{Go}(e')=a \wedge \mathrm{Th}(e') \in {}^*\mathrm{FLOWER} \wedge |\mathrm{Th}(e')|=3$

The sum of giving events e whose agent is a sum of two students, whose goal is a sum of four professors, and whose theme is a sum of flowers, and whose sub-events partition into sums of events with one professor as goal, and three flowers as theme. The latter means that per professor, the sum of all the sub-events with that professor as goal has a sum of three flowers as theme.

We propose to adopt a comparable analysis for the VP in the relative clause in (69):

(72) $\lambda e.\mathrm{BUY}(e) \wedge \mathrm{Ag}(e) \in {}^*\mathrm{CHILD} \wedge |\mathrm{Ag}(e)|=3 \wedge \mathrm{Th}(e) \in {}^*\mathrm{APPLE}$
$\wedge\ \forall a \in \mathrm{ATOM}(\mathrm{Ag}(e)): \exists e' \sqsubseteq e: \mathrm{Ag}(e')=a \wedge \mathrm{Th}(e') \in {}^*\mathrm{APPLE} \wedge |\mathrm{Th}(e')|=2$

The set of buying events with three children as agent and a sum of apples as theme such that the sub-events partition into sums of events with one child as agent and altogether two apples as theme. The latter means that for each child the sum of all the sub-events with that child as agent has a sum of two apples as theme.

To this we apply ChR:

(73) $\lambda x.\lambda e.(72)(e) \wedge \boldsymbol{C}_{(72)}(e)=x$

We assume in context k an *exactly* implicature for *three children*, and we assume that $\boldsymbol{C}_{k,(72)} = \mathrm{Th}$. We derive the relative clause property (74) and the definite (75):

(74) $\lambda x.\exists e[BUY(e) \wedge Ag(e) \in *CHILD \wedge |Ag(e)|=3 \wedge Th(e) \in *APPLE \wedge Th(e)=x$
$\wedge \ \forall a \in ATOM(Ag(e)): \exists e' \sqsubseteq e: Ag(e')=a \wedge Th(e') \in *APPLE \wedge |Th(e')|=2]$

The set of objects x such that there is a sum of buying events e with three children as agent, x as theme, x a sum of apples, and e partitioning into sums of events with one of the children as agent and altogether two apples as theme. The latter means that for each child the sum of all the sub-events with that child as agent has two apples as theme.

(75) $\sigma(\lambda x.\exists e[BUY(e) \wedge Ag(e) \in *CHILD \wedge |Ag(e)|=3 \wedge Th(e) \in *APPLE \wedge Th(e)=x$
$\wedge \ \forall a \in ATOM(Ag(e)): \exists e' \sqsubseteq e: Ag(e')=a \wedge Th(e') \in *APPLE \wedge |Th(e')|=2])$

If $child_1$ bought $a_1 \sqcup a_2$ in event e_1 and $child_2$ bought $a_3 \sqcup a_4$ in event e_2 and $child_3$ bought $a_5 \sqcup a_6$ in event e_3 and no child bought any other apple, then the VP in (69) denotes (76):

(76) $\{e_1 \sqcup e_2 \sqcup e_3\}$, where $Ag(e_1 \sqcup e_2 \sqcup e_3) = child_1 \sqcup child_2 \sqcup child_3$ and
$Th(e_1 \sqcup e_2 \sqcup e_3) = a_1 \sqcup a_2 \sqcup a_3 \sqcup a_4 \sqcup a_5 \sqcup a_6$,

That is, the only event that is big enough to have all the apple buying events of the individual children as part is $e_1 \sqcup e_2 \sqcup e_3$. Not, surprisingly, then, the theme of $e_1 \sqcup e_2 \sqcup e_3$ is going to be the only object in the relative clause denotation (77a), and this makes the definite defined with denotation (77b):

(77) a. $\{a_1 \sqcup a_2 \sqcup a_3 \sqcup a_4 \sqcup a_5 \sqcup a_6\}$
b. $a_1 \sqcup a_2 \sqcup a_3 \sqcup a_4 \sqcup a_5 \sqcup a_6$

4.6. *Every student three papers*

One of the most interesting cases is the example in (78), mentioned by Shimoyama 1999, 2001 for which so far nobody has provided an analysis.

(78) Wasaburo-wa [[*dono gakusei-mo* ***peepaa-o*** ***3-bon*** dasita]-no]-o
Wasaburo-Top[*every student* ***term-paper-Acc 3-Cl*** turned-in]-NM-Acc
itiniti-de yonda.
one-day-in read
'*Every student turned in* ***three term papers*** and Wasaburo read ***them*** (= all the papers that all the students turned in) in one day.'

This is the right place to show that if we apply a standard scope mechanism in (78), we will get a wrong interpretation. We apply the scope mechanism to the DP *dono gakusei-mo/every student*, store its meaning and retrieve it later, after event-existential closure . We start out with:

(79) $\lambda e.TURN\text{-}IN(e) \wedge Ag(e)=a_k \wedge Th(e) \in *PAPER \wedge |Th(e)|=3$
STORE: $<a_k, \lambda P.\forall z[STUDENT(z) \rightarrow P(z)]>$

To this we apply ChR:

(80) $\lambda x.\lambda e.(79)(e) \wedge \boldsymbol{C}_{(79)}(e)=x$

We assume that in context k, $\boldsymbol{C}_{k,(79)}$ = Th. This gives (81):

(81) $\lambda x \lambda e.\text{TURN-IN}(e) \wedge \text{Ag}(e)=a_k \wedge \text{Th}(e) \in *\text{PAPER} \wedge |\text{Th}(e)|=3 \wedge \text{Th}(e) = x$
STORE: $<a_k, \lambda P.\forall z[\text{STUDENT}(z) \rightarrow P(z)]>$

We apply (81) to the free variable denoted by the trace of the null operator in [Spec, ChR] (call it x), do event existential closure, quantify in *every student*, abstract over the free variable x, and get the relative clause property (82) and the definite expression (83):

(82) $\lambda x.\forall z[\text{STUDENT}(z) \rightarrow$
$\exists e[\text{TURN-IN}(e) \wedge \text{Ag}(e)=z \wedge \text{Th}(e) \in *\text{PAPER} \wedge |\text{Th}(e)|=3 \wedge \text{Th}(e)=x]$

(83) $\sigma(\lambda x.\forall z[\text{STUDENT}(z) \rightarrow$
$\exists e[\text{TURN-IN}(e) \wedge \text{Ag}(e)=z \wedge \text{Th}(e) \in *\text{PAPER} \wedge |\text{Th}(e)|=3 \wedge \text{Th}(e)=x])$

To be in the denotation of (82), x should be such that for every student there is an event of that student turning in x, a sum of three papers. This is, of course, not going to be true, since the students turn in different papers.

What we propose for this example is that here, too, the VP has a cumulative interpretation, and the scope relation is introduced adverbially.
Thus we assume the following VP event type:

(84) $\lambda e.\text{TURN-IN}(e) \wedge \text{Ag}(e) \in *\text{STUDENT} \wedge \text{Th}(e) \in *\text{PAPER}$
$\wedge \forall a \in \text{ATOM}(\text{Ag}(e)): \exists e' \sqsubseteq e: \text{Ag}(e')=a \wedge \text{Th}(e') \in *\text{PAPER} \wedge |\text{Th}(e')|=3$

The set of turning-in events with students as agent and papers as theme such that for each student the set of sub-events with that student as agent has a sum of three papers as theme.

From here the story is the same as in the previous example. We apply ChR:

(85) $\lambda x.\lambda e.(84)(e) \wedge \boldsymbol{C}_{(84)}(e)=x$

We assume choose role function picks in context k role Th, and we derive the relative clause property (86) and the definite expression (87):

(86) $\lambda x.\exists e[\text{TURN-IN}(e) \wedge \text{Ag}(e) \in *\text{STUDENT} \wedge \text{Th}(e) \in *\text{PAPER} \wedge \text{Th}(e)=x$
$\wedge \forall a \in \text{ATOM}(\text{Ag}(e)): \exists e' \sqsubseteq e: \text{Ag}(e')=a \wedge \text{Th}(e') \in *\text{PAPER} \wedge |\text{Th}(e')|=3]$
(87) $\sigma(\lambda x.\exists e[\text{TURN-IN}(e) \wedge \text{Ag}(e) \in *\text{STUDENT} \wedge \text{Th}(e) \in *\text{PAPER} \wedge \text{Th}(e)=x$
$\wedge \forall a \in \text{ATOM}(\text{Ag}(e)): \exists e' \sqsubseteq e: \text{Ag}(e')=a \wedge \text{Th}(e') \in *\text{PAPER} \wedge |\text{Th}(e')|=3])$

(86) denotes the set of objects x such that there is a sum of turning-in events e with students as agent, x as theme, x a sum of papers, and e partitioning into sums of events

with one of the students as agent and altogether three papers as theme. The definite expression (87) denotes (88a), presupposing (88b).

(88) a. The sum of all the papers turned-in by the students.
b. Every student turned in three papers.

For completeness, we note that if in (78) we replace the internal head *peepaa-o 3-bon* 'three term papers' with *sukunakutomo peepaa-o 3-bon* 'at least three term papers', a suitably modified (86), i.e., with the symbol '=' replaced by '≥', call it (86'), will not necessarily denote a singleton set, but it will have a maximal element, namely the sum of all papers turned-in by students (this is the effect of the cumulative interpretation of students and papers). Correspondingly, (87') (i.e., (87) with '=' replaced by '≥') will denote (88a), presupposing (88'b).

(88') b. Every student turned in at least three papers.

Returning now to (78), we get the correct cumulative interpretation of the internally-headed relative by assuming that (89) has a cumulative interpretation with the scopal relation introduced adverbially, i.e. an interpretation along the lines of (90b):

(89) [[dono gakusei-mo **peepaa-o** **3-bon** dasita]-no]-o
every student **term-paper-Acc 3-Cl** turned-in-no-Acc
(90) a. Every student handed in three papers.
b. Students handed in papers, **three papers per student**.

One way in which this interpretation differs from the standard interpretation of (90a) is that the cumulative interpretation of (90b) has an existence presupposition, whereas the standard interpretation of (90a) only has an existence implicature. In other words, (90b) expresses that there are students, and hence there are students that handed in papers. Now, in the context of (78) this presuppositional interpretation is entirely warranted: (78) presupposes that there are students and that there are papers handed in. So, this bit of the interpretation is not a problem in the context of internally-headed relatives. You might even take it as evidence for the analysis, but that really goes too far, because the definite operator is all by itself quite enough to bring in the correct presuppositional effect (assuming that the rest of the analysis is ok).

The analysis of (90a) through (90b) is exactly along the lines of the suggestion in Landman 2000 - following in essence Moltmann 1992 - that the internal readings of *same* and *different* are best treated through adverbially added dependency relations. That is, the proposal there is that the internal reading of (91a) is analyzed along the lines of (91b):

(91) a. Every waitress served a different guest.
b. Waitresses served guests, *a different guest per waitress*.

The point we are trying to make here is this: there are, we think, strong independent reasons for assuming the existence of a scope mechanism that derives an interpretation for (91a) along the lines of (91b), and of (90a) along the lines of (90b). With this, we assume that there is strong independent reason to assume that the grammar contains a

mechanism that derives (84) as one of the interpretations for the internally headed relative clause in (78).

Once we make this one assumption, the choose role semantics *unproblematically* derives the correct reading for (78). In fact, the simplicity of the resulting analysis can all by itself be regarded as a piece of evidence in favor of the kind of local scope mechanism discussed above.

While Shimoyama pointed out examples like (78), she did not attempt a semantic analysis of them, and there is, at present, no alternative semantic analysis of internally headed relatives like (78).

What has been analyzed are discourse anaphora cases like (92):

(92) Every student turned in **three term papers**. Wasaburo read **them** in one day.

Krifka 1996 proposed a discourse semantics for such examples in terms of parametrized individuals. We think that it is fair to say that Krifka's analysis of these cases is frightfully more complex than what we propose for internally headed relatives like (78). We think that here too, modeling the property reconstruction procedure in discourse anaphora on the semantic analysis of similar cases of internally-headed relatives (which means extracting in context the event type in (84) from the preceding discourse) may lead to a simpler account of the discourse anaphora cases as well.

5. Roles in conjunctions, conjunctive roles

5.1. Conjunctive roles.

(93) [[**Keisatsukan**-ga **doroboo**-o oikakete-i-ta]-no]-ga
policeman-NOM robber-ACC was chasing-no-NOM
futari-tomo ayamatte gake-kara oti-ta.
two accidentally cliff-from fall-PAST
'A policeman was chasing **a robber** and **they *both*** fell off the cliff accidentally.'

(93) is mentioned in G (his example (58)), and also in earlier literature.
Context k determines for event type α $\mathbf{SR}_{k,\alpha}$, the set of roles that are salient in k, defined for all events in α, and satisfy the Induced Relevancy Condition. Obviously, in an event type corresponding to a VP, the most salient roles are the ones grammatically introduced corresponding to arguments or adjuncts in the VP. Clearly, lots of functions from events to objects that exist in the domain of type <e,d> are not going to be salient, say, a diagonal role, that picks for each event in α the value of a different role, defined for that event. Examples like (93) are interesting, because they show both the contextual possibilities and limitations available in $\mathbf{SR}_{k,\alpha}$.

The event type of the VP in the relative clause is (94):

(94) $\lambda e.\mathrm{CHASE}(e) \wedge \mathrm{Ag}(e) \in \mathrm{COP} \wedge \mathrm{Th}(e) \in \mathrm{ROBBER}$

We define the following role:

(95) λe.Ag(e)⊔Th(e)

Since the roles Ag and Th are both defined for all the events in event type (94), the role λe.Ag(e)⊔Th(e) is also defined for all events in event type (94). Is this role in $\mathbf{SR}_{k,(94)}$? The situation is as follows: Akira Watanabe (p.c.) informs us that if you leave out *futari-tomo* (both) in the main clause, the intended reading virtually vanishes, and the entire sentence, while grammatical, is construed as saying that the policeman (alone) fell off the cliff. For our consultant then, in a normal context, the complex role λe.Ag(e)⊔Th(e) is not salient enough to be chosen, without further triggers. But, apparently, the trigger allows the complex role in. Thus, if k is the context we start out with, out of the blue, we can let $(k + \mathbf{tr})$ be itself a context, which is just like k, but taking the effect of trigger tr into account. Thus, while λe.Ag(e)⊔Th(e) is not in $\mathbf{SR}_{k,(94)}$, we assume that λe.Ag(e)⊔Th(e) ∈ $\mathbf{SR}_{k+futari\text{-}tomo,(94)}$.

We apply ChR:

(96) $\lambda x.\lambda e.(94)(e) \wedge \boldsymbol{C}_{(94)}(e)=x$

and we assume that in context (k+*futari-tomo*) $\boldsymbol{C}_{k+futari\text{-}tomo,(94)}$ = λe.Ag(e)⊔Th(e).
This derives relative clause (97) and definite (98):

(97) λx.∃e[CHASE(e) ∧ Ag(e) ∈ *COP ∧ Th(e) ∈ *ROBBER ∧ Ag(e)⊔Th(e)=x]

(98) σ(λx.∃e[CHASE(e) ∧ Ag(e) ∈ *COP ∧ Th(e) ∈ *ROBBER ∧ Ag(e)⊔Th(e)=x])

Assuming a story with only one cop c and one robber r relevant, the relative clause denotes (99a) and the definite (99b), which forms the proper input for the distributive property in the main clause:

(99) a. {c⊔r}
b. c⊔r

(There may, of course, be speakers for whom the present example doesn't need a plural trigger. In that case, the analysis is even simpler: the complex role would be salient enough to be in $\mathbf{SR}_{k,(94)}$.)

5.2. Roles in conjunctions.

(100) [[**Otokonoko**-ga donatte-i-te **onnanoko**-ga urusaku-si-te-ita]-no]-ga
boy-nom was.shouting-and **girl-nom** was being-too.loud-no-Nom
futari-tomo sensei-ni shika-rare-ta.
two.of.them teacher-by scold-pass-past
'A boy was shouting and **a girl** was being too loud and **they *both*** were scolded by the teacher.'

(100) is also mentioned in G (his example (62)). G's example has plural trigger *futari-tomo* (both) in the main clause, like the previous example. However, this time Akira Watanabe (p.c.) tells us that the example is perfectly felicitous also without the trigger. Our analysis in this case does not depend on the trigger.

The conjunction inside the relative clause in (100) is arguably not VP conjunction, but conjunction at the level of a higher phrase, AspP, TP or CP. Given that ChR takes a VP complement, it follows on our analysis that (100) must involve two instances of ChR, each merged with a distinct V, and each selecting a role in the event denoted by its VP sister. Let us start out with this. We have two VPs (101a) and (101b):

(101) a. $\lambda e.\mathrm{SHOUT}(e) \wedge \mathrm{Ag}(e) \in \mathrm{BOY}$
b. $\lambda e.\mathrm{BE\ TOO\ LOUD}(e) \wedge \mathrm{Th}(e) \in \mathrm{GIRL}$

We apply ChR to each of these and form:

(102) a. $\lambda x.\lambda e.(101a)(e) \wedge \boldsymbol{C}_{(101a)}(e)=x$
b. $\lambda x.\lambda e.(101b)(e) \wedge \boldsymbol{C}_{(101b)}(e)=x$

In context k, we assume that $\mathbf{C}_{k,(101a)} = \mathrm{Ag}$ and $\mathbf{C}_{k,(101b)} = \mathrm{Th}$.
We derive:

(103) a. $\lambda x.\lambda e.\ \mathrm{SHOUT}(e) \wedge \mathrm{Ag}(e) \in {}^*\mathrm{BOY} \wedge \mathrm{Ag}(e)=x$
b. $\lambda x.\lambda e.\ \mathrm{TOO\ LOUD}(e) \wedge \mathrm{Th}(e) \in {}^*\mathrm{GIRL} \wedge \mathrm{Th}(e)=x$

These two instances of ChR will generate two null operators, each of which must raise. Thus, the traces of the respective null-operators will give:

(104) a. $\lambda e.\ \mathrm{SHOUT}(e) \wedge \mathrm{Ag}(e) \in \mathrm{BOY} \wedge \mathrm{Ag}(e)=x_1$
b. $\lambda e.\ \mathrm{TOO\ LOUD}(e) \wedge \mathrm{Th}(e) \in \mathrm{GIRL} \wedge \mathrm{Th}(e)=x_2$

Semantically, existential closure will take place, and we get (105):

(105) a. $\exists e[\mathrm{SHOUT}(e) \wedge \mathrm{Ag}(e) \in \mathrm{BOY} \wedge \mathrm{Ag}(e)=x_1]$
b. $\exists e[\mathrm{TOO\ LOUD}(e) \wedge \mathrm{Th}(e) \in \mathrm{GIRL} \wedge \mathrm{Th}(e)=x_2]$

The details of the remainder of the derivation will vary somewhat depending on where we assume where the conjunction takes place. Technically the easiest is to assume that

the conjunction takes place at the CP level. In this case, the two null operators each move to the [Spec CP] or their respective conjunct CP, and abstraction takes place there. This gives (106):

(106) a. $\lambda x.\exists e[\text{SHOUT}(e) \wedge \text{Ag}(e) \in \text{BOY} \wedge \text{Ag}(e)=x]$
b. $\lambda x.\exists e[\text{TOO LOUD}(e) \wedge \text{Th}(e) \in \text{GIRL} \wedge \text{Th}(e)=x]$

While relative clauses are predicates, and normally conjoined by means of *intersection*, in this case intersection gives the wrong reading. As discussed in Lasersohn 1995 and Landman 2004, the proper operation for conjoining sets of pluralities is the operation of sum pairing:

(107) **Sum-pairing**
$\alpha \sqcap \beta = \lambda x.\exists a \exists b[\alpha(a) \wedge \beta(b) \wedge x = a \sqcup b]$

With sum pairing, we derive a relative clause interpretation (108) and a definite expression (109):

(108) $\lambda x.\ \exists a \exists b[x = a \sqcup b \wedge \exists e[\text{SHOUT}(e) \wedge \text{Ag}(e) \in \text{BOY} \wedge \text{Ag}(e)=a] \wedge \exists e[\text{TOO LOUD}(e) \wedge \text{Th}(e) \in \text{GIRL} \wedge \text{Th}(e)=b]]$

The set of all sums of two individuals, one of which is a boy who is shouting and the other is a girl who is too loud.

(109) $\sigma(\lambda x.\ \exists a \exists b[x = a \sqcup b \wedge \exists e[\text{SHOUT}(e) \wedge \text{Ag}(e) \in \text{BOY} \wedge \text{Ag}(e)=a] \wedge \exists e[\text{TOO LOUD}(e) \wedge \text{Th}(e) \in \text{GIRL} \wedge \text{Th}(e)=b]])$

The definite in (109) not only requires the set in (108) to have a maximum, but *futari-tomo* (both) in the main clause, of course, requires (109) to be a sum of two individuals. Hence, in context, we get (110a) and (110b) for the denotation of the relative and the definite:

(110) a. $\{b \sqcup g\}$ where b is the boy mentioned who was shouting and g the girl mentioned who was too loud
b. $b \sqcup g$

Again, the denotation of the definite forms the proper input for the distributive statement in the main clause.

6. Conclusion.

We have reanalyzed the category ChR from Grosu (2010) in a way that (i) ensures predicate formation at the relative CP level over the variable it introduces, (ii) motivates the merger of a null operator in [Spec, ChR], and (iii) utilizes in its translation only symbols that belong to the object-language.

Semantically, ChR chooses a role which is defined, and salient for the events in the VP event type, and satisfied the Induced Relevancy Condition. In practice, the role will usually be one that has already been specified inside the VP, which means, *de facto*, that the value of that role in the VP interpretation gets re-opened (quantificational disclosure), so that [Spec, ChR] will abstract over it. Unlike earlier analyses of Japanese/Korean internally-headed relatives, the present analysis assigns to the internally-headed structures an analysis that is *surprisingly close* to a standard syntactic and semantic analysis of relative clauses.

The similarities with discourse anaphora, which so strongly motivated earlier analyses, are real, but misleading. Both in the present construction, and in discourse anaphora there is a definite operation, which seeks a property which requires the sum of the objects it applies to to be itself an object it applies to (Kadmon 1990's uniqueness).

In the relative clause construction, the relevant property is of course what the relative clause semantics builds. In discourse anaphora this property is to be constructed in discourse. But the way this is done is much in analogy to what our semantics for internally-headed relative clauses does: look at a sentence in previous discourse (a VP), identify a role, reopen it, and form a predicate. Both the procedure proposed in Kadmon 1990, and similar procedures in dynamic theories of discourse anaphora based on existential disclosure (e.g. Dekker 1993, Chierchia 1995) can be seen as variants of this procedure. Thus, the similarities do not derive from the fact that internally-headed relatives are like discourse anaphora, but *vice versa* from the fact that building the property that a discourse anaphor requires is semantically similar to what happens in the semantics of internally-headed relatives.

We gave the semantic analysis of a series of examples of increasing complexity (in section 4) to show, of course, how well the semantics works, but also to bring out the fact that it works, because of the prominent availability in Japanese and Korean of a mechanism of cumulative (scopeless) interpretations of the arguments, with scopal properties and scopal relations added conjunctively, adverbially, and that means: without creating scopal relations with the scopeless arguments.

We argued that for cases where the internal head is in the scope of a quantifier, the simplicity of the analysis with the help of a local scope mechanism is a strong argument in favor of the latter mechanism, in particular since existing analyses of related cases with discourse anaphora are in comparison immensely complex.

Finally we showed that the analysis extends unproblematically to cases where ChR selects a complex role, and cases involving selection of multiple roles in conjunction, the latter providing a new application of the well-established conjunction operation of sum-pairing.

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