AKADÉMIAI KIADÓ

Lifelong (mind) representationalism in dynamic semantics

GÁBOR ALBERTI* and JUDIT KLEIBER

ℜeALIS Theoretical, Computational and Cognitive Linguistics Research Team, Linguistics Department, University of Pécs, Hungary

ABSTRACT

motto: *Nem érünk rá arra, hogy ne a dolgok végső okát kutassuk* 'We've got no time not to search into the ultimate reason of things' László Kálmán (p.c., in the nineties)

Our point of departure is László Kálmán's system of radical anti-mainstream argumentations about such central but dubious, or at least debated, constituents and concepts of dynamic semantics as discourse representation, information state, compositionality between semantics and syntax, bridging, deferred information, and ambiguity/vagueness. We strive for pointing out that Kálmán's observations and stances concerning these fundamental, ultimate problems of pragmasemantics are worth relying upon the formal theory that is to realize the desirable purpose of creating a version of formal pragmasemantics simultaneously capable of meeting the criteria and requirements appearing in different non-logics-based/informal areas of the description of human communication and – what is behind it – thinking.

KEYWORDS

dynamic (pragma)semantics, discourse representation, compositionality, bridging, ambiguity

* Corresponding author. E-mail: alberti.gabor@pte.hu

1. INTRODUCTION

The paper mainly discusses László Kálmán and his colleagues' generally radical anti-mainstream trains of thoughts about such central but dubious, or at least debated, constituents and concepts of dynamic semantics as discourse representation, compositionality, and different forms of intersentential cohesion. As indicated in the abstract, we claim that these trains of thoughts form a uniform system that is worth basing a viable integrating formal theory of dynamic pragmasemantics upon.

Before entering into the internal affairs of the nineties' formal dynamic semantics, it is necessary to sketch the difference between the representationalist and antirepresentationalist approaches (Kálmán & Rádai 2001) in the post-static-semantic "post-Montagovian formal semantics community" (Partee 1996). Sections 2 and 3 are devoted to this purpose. Section 2 provides a rich illustration of different types of discourse (and mental state) representation while section 3 concentrates on such crucial metatheoretical questions concerning discourse representation as their alleged illegitimacy as a superfluous "extra level" of representation and their Janus-faced status in semantics description.

In section 4 it is questioned, following Zadrozny (1994, 329), Kálmán (1994, 4.2), and Kálmán, Kurucz & Szabó (2004, 95–99), that "compositionality between syntax and semantics should inevitably be defined as the property that the meaning of a whole is a function of the meaning of its parts" (Keenan & Faltz 1985, 24–25).

Section 5 discusses two types of intersentential coherence. We argue that both bridging phenomena (Kálmán 1990; Kálmán & Szabó 1990, 125) and a monotonic solution to a basic type of scope ambiguity (Kálmán 1990, 3.2.3) require the decomposition-based discourse-representation-via-mind-representation approach that $\Re$eALIS (Alberti 2011; Alberti & Kleiber 2012, 2014; Alberti et al. 2019) provides.

The conclusion in section 6 is completed with a few remarks on "loose ends" in the area of bridging phenomena.

2. A SEMIFORMAL INTRODUCTION TO THE ART OF DISCOURSE/ INFORMATION-STATE REPRESENTATION

This section provides an introduction to the art of discourse representation through the demonstration of a few discourse representation structures (DRSs).

This introduction – and the whole paper – can be called "semiformal", whilst dynamic semantics is undoubtedly a highly formalized area of linguistics (and philosophy). This paper is not the place for a detailed, formally explicit, uniform presentation of the formalism, a particular precisely elaborated version out of competing formalisms; such a presentation would take up too much space and would detract from the central point of the paper (but see Geurts, Beaver & Maier 2023). Nor does this paper undertake to provide a systematic introduction to the dynamic semantics and/or discourse representation theories of the nineties. For Hungarian-speaking readers, Kálmán & Rádai's (2001) *Dinamikus szemantika* can serve as an excellent introduction to the story of different branches of dynamic semantics. One branch, the *representational(ist)* alternative, is given a systematic formal demonstration in Kamp's and his

followers' such works.[1] The other branch, that of the Amsterdam-based *antirepresentationalists*, are launched in Groenendijk & Stokhof (1990, 1991).[2] It is also worth reading Partee's (1996, 25–38) paper, who provides an excellent review of the post-Montagovian decades of formal semantics after Montague's untimely death in early 1971, which can be characterized by the fact that in spite of the great diversity within and around the field of formal semantics, there does exist a (loose) "formal semantics community" across which discussion and debate is possible and fruitful, with Montague Grammar (Montague 1973; see Dowty, Wall & Peters 1981) serving as a reference point in the background.

It is the self-explanatory visual display of DRSs that we think may make the semiformal presentation sufficient in this paper: the famous Kampian box structure. The (one-box) DRS[3] given in Figure 1 expresses the content of the example sentence in (1) as follows. The sentence makes a statement about three referents, marked by x, y, and z; of which z is claimed to be a professor, y a book, and x a student of z; see, respectively, the second, third, and fifth rows, of the six rows in the lower box. It is claimed in the other three rows that the professor recommends the book to the student (first row),[4] the book is useful (fourth row), and the student is clever (sixth row). In a DRS, thus, the complex statement expressed by a sentence (or a coherent sequence of sentences) is decomposed into elementary, minimal statements (or at least to smaller chunks, in "transitory" DRSs which display partial decomposition of information).

(1)   A professor recommends a useful book to his clever student.

The alternative DRS in Figure 2 presents a stronger decomposition of information expressed by sentence (1), according to the formalism proposed in ℜeALIS (Alberti 2008, 2011, 2012;
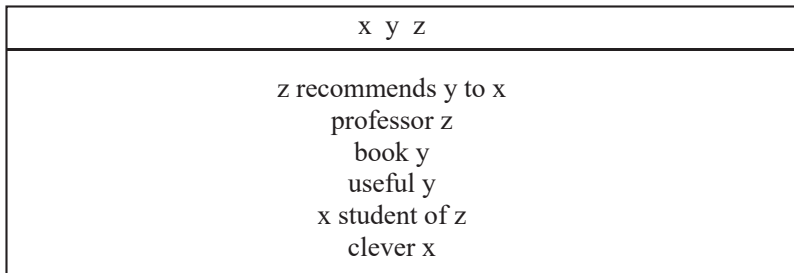

x y z
z recommends y to x
professor z
book y
useful y
x student of z
clever x

Figure 1. The DRS that can be produced based on ex. 3.106 in Kamp & Reyle (1993, 292)

---

[1] Such works are Kamp (1981), Partee (1984a, b) Kálmán (1990), Kálmán & Szabó (1990), Kamp & Reyle (1993), Kamp, Genabith & Reyle (2011), Asher & Lascarides (2003), and Alberti (2000a); and in the following works, representation-alism is also extended from discourse to mind / mental/information states / pragmatics: Kamp (1990), Kamp & Bende-Farkas (2019), Maier (2010, 2016), Alberti (2008, 2011, 2012), Alberti & Kleiber (2010, 2012, 2014), Alberti & Nőthig (2015), Alberti & Szeteli (2018), Alberti et al. (2019), Á. Szeteli et al. (2023).

[2] Further useful sources are Groenendijk, Stokhof & Veltman (1996), Dekker (2000), Elbourne (2005), and Lauer (2013).

[3] It is a simplified version in a sense that discourse referents that belong to temporal and spatial objects (Karttunen 1976), for instance, are either omitted or left without any explanation in this paper.

[4] The three participants are referred to as definite ones in this clause; but they are definite only in the internal miniworld of the situation sketched while it is possible that neither the hearer nor the speaker have two definite persons and a definite book in their minds.

z recommends y to x	
professor z'	z'→z
book y'	y'→y
useful y"	y"→y'
x' student of z"	x'→x z"→z'
clever x"	x"→x'

Figure 2. A representation of the information provided by sentence (1) in ℜeALIS

Alberti & Kleiber 2010, 2012, 2014). In this representation the six elementary statements are displayed as if they had come from some lexicon, in which, in each lexical item, the arguments are referred to by different referents, which are to be unificated later, having been inserted in sentences, according to the grammatical relations "creating" the given sentences.[5] In the representation in Figure 2, there are nine different referents.[6] The simple formulae with arrows are to register the particular instances of identification of referents on the basis of particular grammatical relations. We consider it plausible, relying upon straightforward grammatical wisdom, that the grammar renders professor z' identical to 'the recommender' (z), the book (y') to the recommended thing (y), the useful thing (y") to the book (y'), the student (x') to the person to whom the book is recommended (x), the teacher of the student (z") to professor z', and the clever person (x") to the student (x'), from row to row. There is, however, no (plausible) grammatical rule to render the useful thing (y") to the recommended one (y), that is, there is no unification [y"→y] in Figure 2. Similarly, there is no direct connection [x"→x'] as there is no grammatical rule to connect that claimed to be clever (x") with that claimed to be the target of recommendation (x).

One might think that Figure 2 is only a – less reader-friendly – variant of Figure 1 since the system of the three referents in Figure 1 actually carries the same information as the nine referents in Figure 2 identified in three's (x = x' = x", y = y' = y", z = z' = z") by the *closure* of the unidirectional operation '→', discussed in the previous paragraph.[7] That is not the case, however: the unidirectional variant of unification may prove to be useful in defining a concept of *distance* between lexical items in our minds that suggests a straightforward solution to bridging phenomena, see 4.1. As for the ontological status of this ℜeALIS-concept of referents in our minds, it is similar to Landman's (1986) concept of *pegs*: pieces of information are to be "hung" on them, they serve this purpose, but they remain independent of the information associated with them (while Kampian discourse referents seem to serve as representatives of things).

---

[5]By 'unification' PROLOG-style mechanisms are meant (see Alberti, Balogh & Kleiber 2002; Alberti et al. 2003; Alberti & Kleiber 2004).

[6]Referents x, x', and x", for instance, are three different referents, which we have given similar symbols (ones with a shared *x* component) only in order to help the reader in comprehending the *later* procedure of unification.

[7]By 'closure' mathematicians mean, for a relation, an extended relation. In the particular case, if [ξ→ξ'] and [ξ'→ξ"] are in the original relation, then [ξ→ξ] is in the extended one due to commutativity, and [ξ→ξ"] is also in the extended relation, due to transitivity; and it can then be calculated that all the six pairs out of the triplet [ξ, ξ', ξ"] are in the closure.

Let us now consider a sentence with a quite complicated logical structure (2). Although only one implicative 'if … then' construction can be observed, the two copies of the quantifier determiner 'every' practically provide two further implications: 'if we find a student/professor (in a "restrictor" set the consideration of which is rationally to be assumed) then (s)he is such that …'. An implication in logics corresponds, in Kamp & Reyle's (1993) DRT, to a partially ordered system of three boxes, of which the biggest one includes the two smaller ones, linked by the symbol ⇒ of implication. The box structure presented in Figure 3 is created by the triple recursive application of this three-box configuration (with different contents). It cannot be a task of this paper to point out that the resulting box hierarchy can be associated with a procedure of model-based interpretation (starting from outside) that would yield exactly the interpretation logicians would assign sentence (2). What is relevant to us at this point is only that the separation of referents in different box levels will define the desirable scope hierarchy among what are regarded as *operators* in the world of logicians and syntacticians. We may help the beginners of DRT in understanding the – essentially procedural – spirit of the approach of this branch of dynamic semantics by raising the attention to the positions of the four referents.[8] First of all, none of them belongs to the referent set of the box including all the other boxes; which means that sentence (2) is not a statement concerning a certain book (or a certain student or professor). Instead, (2) gives its interpreters an instruction: 'you should consider such-and-such books'; the box with y in its referent set corresponds to this "instruction" and the box with y reveals the "reward" obtained in cases has the instruction been met: the book considered can be qualified as useful. In the case in question the "such-and-such" is a highly complex condition primarily on students plausibly associable with the books, to be chosen individually from book to book, and secondarily on professors plausibly associable with the students, to be chosen individually from student to student. The ultimate result of the procedure of interpretation based on three cycles
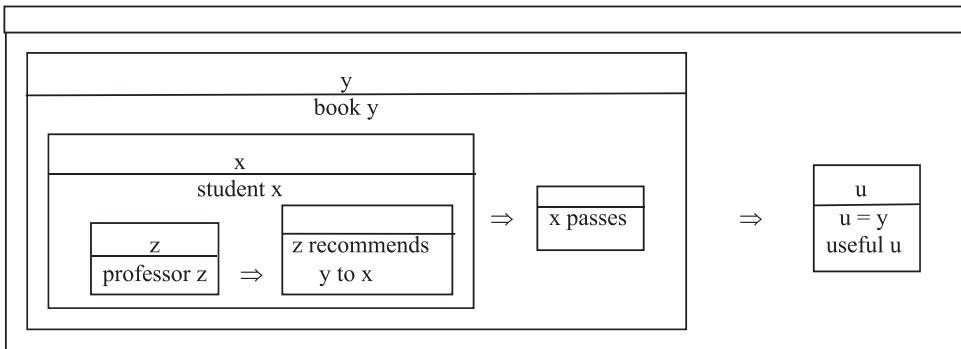

Figure 3. The DRS expressing the content of sentence (2) proposed by Kamp & Reyle (1993, 292, ex. 3.106); NB: it is a simplified DRS in the given framework as temporal/spatial and eventuality referents are omitted

[8]The fourth referent, u, also belongs to a book. It turns out in the course of the procedure of interpretation that this book is to collapse with the book referred to in the *if*-clause, marked by y. It is a prominent topic for DRT that such definite noun phrases as *the book* comes with a referent that "looks for" an antecedent referent introduced in the referent set of a box which includes the box the given referent belongs to.

embedded in each other can simply be formulated as follows: 'a book is useful if each student to whom it has homogeneously been recommended by professors successfully passes'. The box hierarchy controls the interpretation understood as a temporally arranged procedure of evaluating entities referred to in some way in the sentence under interpretation.

(2)   If every student to whom every professor recommends a given book passes then THE BOOK is useful. (Kamp & Reyle 1993, 291, ex. 3.105)

The representation in Figure 4 illustrates how ℜeALIS (Alberti 2011) follows Zeevat's (1991) spirit in striving for the ultimately meagre ontology, seeking the ultimate mathematical simplicity in modeling the discourse-information storing human mind.[9] In this model of the mind, the initial state at one time before birth (Alberti 2000a) is a set of empty pegs (Landman 1986) structured in no way, which then begins to store (discourse) information in the form of hosting three relations building networks of connections among them. The seven symbols e4, book', y''', e10, e11, ⇒, and e12, for instance, are all pegs in the universe of a human mind that happens to store the information coming from sentence (2). One relation among them, marked by σ in Alberti (2011) is simply that arranging them in the two linear orders ⟨e4, book', y'''⟩ and ⟨e10, e11, ⇒, e12⟩. This relation concatenates pegs into formulae, the first element of which is always a symbol referring to an "eventuality" (i.e., a state or an event). Peg e4, for instance,
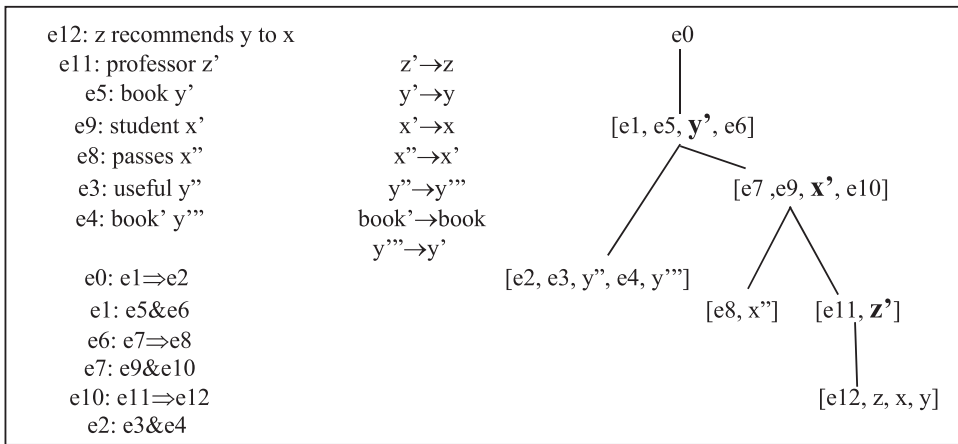

Figure 4. The representation of the information provided by sentence (2) in ℜeALIS

[9] Zeevat (1991, 3.1) formulates this endeavor as follows: "… [a higher order logical apparatus] seems to conflict with the general ideology of [the classical] Discourse Representation Theory, which is 'naïve' in the sense of Davidson. Under such an approach it seems one does not want to refer to all manner of abstract semantic entities, such as properties, properties of properties and the like in natural language semantics." Instead, one is forced to have a relatively meagre ontology: say objects and sentences. It should be noted, however, that the replacement of the "higher order" but well-known semantic entities with the "meagre ontology" comes with the cost of being forced to work with more abstract entities. This replacement can be compared to the replacement of the well-known decimal number system with the binary code (in which, for instance, the well-known number 38 is expressed as 100110).

corresponds to the state that [y''' is a book]. Peg e10 corresponds to an abstract state, according to which there is an implicative relation between the state e11 of [someone being a professor] and the event e12 of [someone recommending something to someone].[10]

The second relation among pegs, marked by α in Alberti (2011), is the unidirectional unification discussed in the comments on Figure 2. The peg y''' of a book, for instance, is presented in Figure 4 to stand in this relation with peg y'', which is 'something useful', and with peg y', which is also a book; for predicates *book* and *book'* are represented as the same mind-internal entities as the pegs/referents that correspond to persons, animals or objects in the world outside, and hence they should also be unified in the same way as these "customary" pegs.[11]

The third relation among pegs, marked by λ in Alberti (2011), captures the mathematical content displayed visually by the Kampian box hierarchy. What is to be partially ordered are not boxes but the pegs/referents they contain; boxes themselves do not belong to the mathematical content. To avoid the chaos that a direct connecting of the pegs shown in Figure 4 would yield, we have drawn a separate tree as a third column in the box. It is to be noted that the partial order the tree presents is not simply the "translation" of the Kampian box hierarchy given in Figure 3; for, in the case of an implication, the boxes on the left and on the right sides of the symbol ⇒ of implication in DRSs are misleadingly displaying non-orderedness between the boxes of the clause of the premise and of that of the conclusion. The universe of the conclusion is in fact available only via that of the premise, by having satisfied the conditions the premise consists of. It is in this way, even in Kampian DRSs, that the procedure of interpretation and the definition of availability among referents are controlled. The pegs belonging to the conclusion are thus to be ordered "later" then those belonging to the premise; hence, for instance, e11<e12, as shown in Figure 4, while the coordinated pegs e9 and e10 are incommensurable.

---

[10]The first column in the box in Figure 4 captures the pieces of information provided by sentence (2) as follows, from row to row. Peg e12 is the representation of the event of someone recommending something to someone. Then three pegs belong to states of being a professor (e11), a book (e5), and a student (e9). Peg e8 refers to the event of someone passes (an exam). Then pegs e3 and e4 belong to states, again; y'' is claimed to be useful, and y''' is claimed to be a book. Due to the recursive character of language, an eventuality can serve as not only the expression of a relation between persons, animals, objects, but also a relation among eventualities. Peg e0 expresses an implicative relation between two states: the state e1 of being a certain (e6) kind of book (e5) and the state e2 of being a useful (e3) book (e4). As referred to by the pegs in parentheses in the last sentence, both e1 and e2 also belong to relations between eventualities. Peg e1 expresses the conjunctive relation between the state of being a book (e5) and the state (e6) of the existence of an implicative relation between the event e8 of someone passing (an exam), as a conclusion, and the complex condition expressed by e7. Peg e7 expresses the conjunctive relation between someone being a student, claimed by e9, and a condition concerning the student, expressed via an implication, marked by e10, between the state of being a professor, e11, as a premise, and an event of recommendation, marked by e12. In the last row, peg e2 is defined as the expression of a conjunctive relation between the states e3 and e4 of being useful and being a book, respectively.

[11]It is the identity of phonetic forms in sentence (2) (*book*) that the unification in question relies upon. It may occur, however, that identity of phonetic forms does not imply the unification of the corresponding predicates. The following sentence serves as an illustration: 'The bank is situated by the bank of the river'. In this case it is obvious that the corresponding pegs *bank* and *bank'* must not be unified. The second column in the box shown in Figure 4 provides all instances of the unidirectional unification α. As discussed in the text above, pegs y, y', y'', and y''' all refer to "the book". Pegs x, x', x'' belong to "the student" while pegs z and z' belong to "the professor". This formulation seems to suggest that something is claimed about three definite entities while the given sentence, obviously, does not pertain to a definite book, a definite student, and a definite professor. It is relation λ that is responsible in ℜeALIS for capturing what is captured by the box hierarchy (and the underlying system of rules of interpretation) in DRT: the participants can practically be multiplied essentially due to the multiplicative power of relative box levels.

The $\mathfrak{R}$eALIS-representation is such that σ, α and λ are all three *labeled* relations (Alberti 2011). This means that each pair ⟨ξ ξ'⟩ in any of the relations is associated with a label that presents why the given two pegs have been set in the given relation. Labels of σ provide information on the positions of the referents in question in their hosting formulae, those of α typically have to do with grammatical relations, and those of λ pertain to interpretation. As indicated above, the same λ-label belongs to 'if … then'- and 'every'-constructions; which controls procedures of interpretation as follows: the statement set of the premise is not a piece of knowledge, or belief, or desire, or intention, but should rather be compared to an electrical socket: if one longs for (not electricity but) what is described in the clause of conclusion they should seek situations which can be "plugged into the socket" of the premise. If a student, for instance, intends to decide whether Kamp & Reyle's (1993) *From Discourse to Logic* is a useful book, then, on the assumption that (2) is a valid observation, they should begin to ask their mates whether the given book is recommended by the relevant professors and whether they are then successful in exams.

We follow Alberti et al. (2024) in assuming that typical λ-labels can essentially be regarded as – recursive closures of – Searlean illocutionary points and forces (Searle & Vanderveken 1985), that is, beliefs, desires, intentions, etc. As illustrated in Figure 5, Kampian boxes can also be understood as complexes of information labeled with indicators of attitudes. This variant of
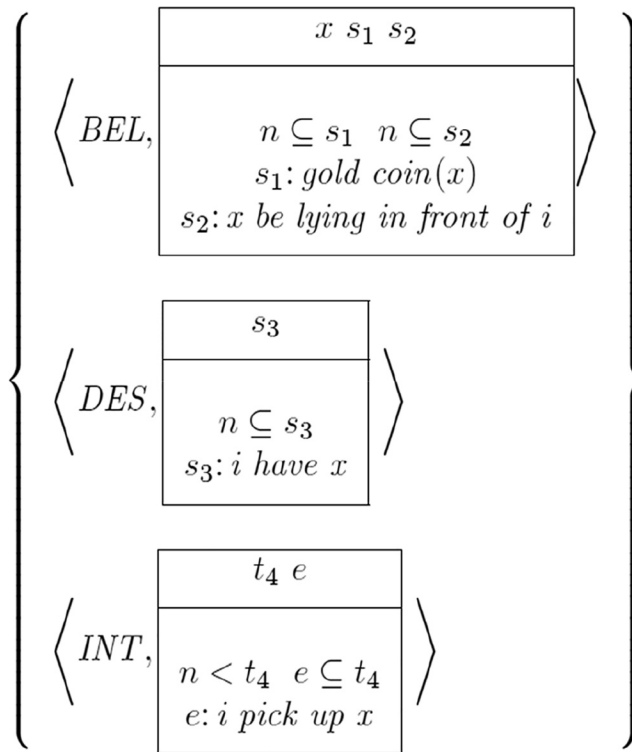

Figure 5. The thought complex consisting of the three attitudes referred to in (3) – the belief, the desire, and the intention – represented as a Mental-State DRS in Kamp & Bende–Farkas (2019, 2.1)

DRT is called *Mental-State DRT* and is characterized by the authors as follows (Kamp & Bende–Farkas 2019, 2.1):

> The formalism should be able to represent not just single attitudes (or the contents of single attitude reports), but also complex mental states made up of several attitudes of distinct attitudinal "modes" (like, say, a belief and a desire) but whose contents may nevertheless be "referentially connected" in the sense that they target one and the same object [as in (3)]. (And, similarly, it should allow for the representation of natural language reports of several attitudes that may be connected to each other in this sense, for instance, through the use of anaphoric pronouns.)

(3)   A person who sees a gold coin in the middle of the road forms the desire to have it in her possession and the intention to go and pick it up, in order to satisfy this desire.

As illustrated in Figure 7 in the context of (4), not only thoughts but even a single sentence may produce the phenomenon of *intensional identity*, that is, identity across possible worlds; for a piece of information, 'your wife', is used to identify a person in the porter's sentence in (4), which belongs to different modal contexts both to the speaker and to the interpreter and, what is more, is held to be false by both. That is, it is known that the girl is not the guest's wife by both the guest, who picked her up ten minutes earlier, and the porter, who knows her as a hooker from the neighborhood; the dark boxes carry these two pieces of information in Figure 7. Nevertheless, the girl is successfully referred to as the subject of *enjoy*; which seems to contradict the principle of *unicity* of appropriate referents as a condition on successful reference. This obvious principle explains why it is not felicitious to say that 'My car has gone wrong' if the speaker has no car or owns two or more cars. The two cases are problematic for different reasons and to distinct extents, but the former case will unquestionably prevent a successful procedure of
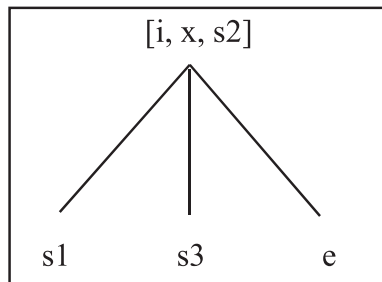

Figure 6. The representation of relation λ in ℜeALIS for the mental information in (3)[12]

---

[12]The representation in Figure 6 uses the same referent names as the one in Figure 5. The hierarchy λ expresses that the speaker (marked by *i*), the object lying in front of him or her (*x*), and the state of it lying in front of the speaker are regarded by the speaker as obviously existing participants / facts of the world while the state s1 of the object being a gold coin is only a belief (or hope), the state s3 of having it is a desire, and the event e of picking it up is an intention. Or rather, what the actual Figure exhibits is that the three latter pegs belong to three worldlets obviously different from both each other and the root worldlet; their aforementioned different modal characters can be captured by the labels that part of what we have referred as a labeled relation. The interested reader is referred to, for instance, Alberti et al. (2019).
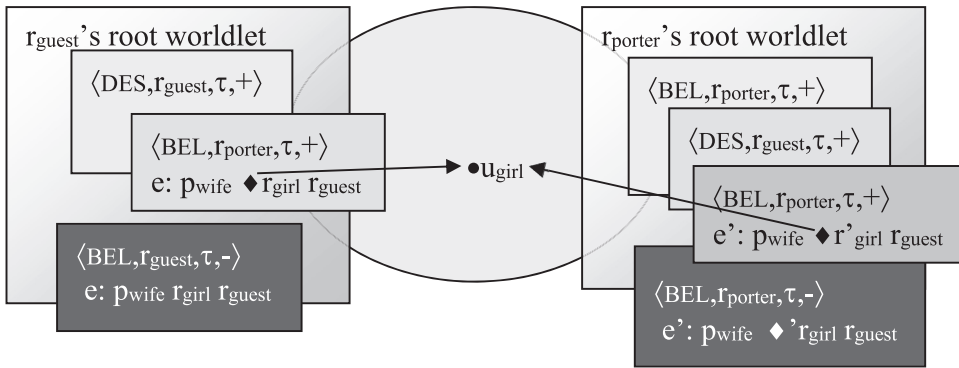
Figure 7. A representation of the information provided by the porter's sentence given in (4) in the version of $\Re$eALIS proposed in Alberti & Kleiber (2012).

referring. Nevertheless, the discourse representation in Figure 7 can offer an explanation for the acceptability of the given sentence based on *unicity* of available referents. What the two worldlet blocks in Figure 7 represent is that *the wife* to the guest is "the unique person in the context such that he (the guest) wants the porter to believe that she is his wife", and *the wife* to the porter is "the unique person in the context such that he thinks that the guest wants him to believe that she is his (the guest's) wife". In certain possible worlds, thus, it is true that the girl is the guest's wife, and in these possible worlds the principle of unicity is met as the guest's potential actual wife is not there in these possible worlds.

(4)   A man arrives at a motel in the company of a girl who is not his wife, in a country where the porter (who knows the girl well…) ought to prevent them, lawfully, to live in the same room. This is against the porter's financial interest, however. Hence, the girl in question will be referred to as the guest's wife by both the guest himself and the porter, despite that neither thinks this "presupposition" to be true; and, moreover, neither thinks that the other considers it to be true, either. The porter says: *I hope your wife will enjoy this champagne.*

Intensional identity is a crucial argument in favor of the representational branch of dynamic semantics, referred to above as Kamp and his followers' branch, since the plausible principle of unicity can be retained and successfully applied to problematic phenomena. Approaches refusing the application of representations, however, referred to as the Amsterdam Circle, have no straightforward solution to intensional identity. These approaches are to capture the semantic contribution of a sentence as an elimination of possible worlds: those which used to be qualified as 'possible' according to the discourse up to the appearance of the given sentence but should be qualified as 'contradictory' having considered the sentence. In an eliminative approach, it cannot be explained that different parts of the sentence under interpretation require distinct ways of eliminating possible worlds (see Farkas 1993, quoted by Roberts 1996, 243).

     We conclude this introduction to dynamic discourse / mind representation with calling the interested readers' attention to a paper by Kleiber (2005), which provides a detailed discourse

semantic analysis of a lengthier financial text on alternative investment opportunities, to be plausibly represented by means of a richly branching tree of possible world(let)s.

3. THE DUBIOUS STATUS OF DISCOURSE REPRESENTATION

As pointed to in the comments concerning (3–4), the occurrence of intensional identity in human languages serves as a crucial argument for basing the theory of discourse processing on discourse representation structures. There are, however, also potential arguments *against* DRSs; of them, this section discusses the two crucial problems.

I. *The dubious status of DRSs.* As pointed out by Kálmán & Rádai (2001, 82), DRSs form an odd transition between formulas of metalanguages and models. On the one hand, a DRS seems to be a symbolic *representation* as it results from interpretation of discourse, and it is not closed under logical operations. On the other hand, it shows the decisive property of a *model / context* that new procedures of interpretation can be based on it, providing *parameters* that the interpretation of sentences depends on.

This Janus-faced status also concerns the gigantic DRS that can be regarded as a model of the human mind, on the assumption that if our mind is assumed to be permanently being fed by DRSs (as the form of incoming information) then it is the obvious model for it: a permanently changing, gigantic, *lifelong* DRS (Alberti 2000a). This lifelong DRS is also a *representation*, on the one hand, as it results from interpretation of discourses, it is not closed under logical operations, while, on the other hand, it shows the decisive property of a *model / context* that new procedures of interpretation can be based on it, and it is used as our data base.

II. *The illegitimate status of DRSs.* DRSs may be viewed as an *extra* level of representation between syntactic structure and the model of world in (the procedure of) interpretation, which can – and hence *must* – be eliminated (NB: a level of representation *must* be eliminated if it *can* be eliminated, on the basis of some Occam's Razor-style metatheoretical principle of economy). In order to understand the relevant details, we should return to "Montague's heritage". Montague himself also applied a level of representation between syntactic structure and world model: a level of logical formulae, about which he proved that *theoretically* this level can be eliminated (Dowty, Wall & Peters 1981). However, a few linguistic problems (like intensional identity, for instance), seem to have proven the opposite, suggesting the necessity of some principle of "discourse representationalism". In other words, some had been led to the conclusion that the cost of introducing an extra level of representation, that of *discourse (representation) structures*, must inevitably be paid. Even Dekker (2000), a researcher who had belonged to Groenendijk and Stokhof's antirepresentationalist Amsterdam Circle in the nineties, tended to accept in 2000 that "some [intermediate] level of representation is indispensable in modeling the interpretation of natural language".

Discourse representationalism, fortunately, should neither be eliminated nor be reduced to a minimum: instead of eliminating the "extra level", the "extra-level problem" should be eliminated, by means of a novel ontology for dynamic pragmasemantics, proposed in the ℜeALIS approach (Alberti 2011; Alberti & Kleiber 2012, 2014). The desirable ontology should

be such that the "extra level" be part of a level of representation the existence of which cannot be questioned.

The cornerstone of the ℜeALIS approach is that DRSs – gigantic ones, of course – are used as *lifelong* representations of interpreters' *information states* (Alberti 2000a), and what serve as objects that play the role of *possible worlds* are practically embedded DRS boxes (i.e., the mathematical constructions they are visual displays of), which are finite information complexes not closed under logical operations. Due to the option of embedding "boxes" in an unbounded series, we can express interpreters' beliefs / desires / intentions (i.e., illocutionary points and forces, see Searle & Vanderveken 1985) including their BDI's concerning BDI's (concerning BDI's)* of each other (Alberti et al. 2024): "possible worlds" are in our minds, that is the answer to Alberti & Kleiber's (2012) question *Where are possible worlds?* An interpreter's information state, thus, is captured formally as a labeled tree system of "worldlets" (the above mentioned finite information complexes, see e.g., (4b)), and can be construed practically as the description of his/her mind – his/her "internal world", which is part of the entire world model also containing the external world.

Hence, ℜeALIS requires no extra level of representation as discourse representations, in company with representations of other contents of these internal worlds, are not outside the world model. By embedding discourse representations in the world model, we can get rid of the intermediate level of representation while preserving its content and relevant structural characteristics. This idea can be carried out in the larger-scale framework of embedding discourse representations in the world model *not directly* but as parts of the representations of interpreters' minds, i.e., their (permanently changing) information states (their internal worlds). In this way, representationalists' useful referent hierarchies (illustrated in section 1) are saved while anti-representationalists' principal theoretical demand pertaining to the elimination of the "extra level" of representation has also been satisfied.

Let us now consider Problem I, which should be reformulated in the new ontology as follows. In the ℜeALIS approach, a double nature is attributed to human minds, which might cause a critical meta-theoretical difficulty: they are *representations* about the "world outside", on the one hand, but – as parts of the entire world model – they are to *be represented* as well, on the other. Note that this duality is essentially the same as the fundamental Searlean concept (Searle 1976, 1) of *direction of fit* (world-to-word and word-to-world, see Searle & Vanderveken 1985, 52–59).

This is no theoretical problem, however, if one has recourse to a *simultaneously recursive definition* of "the whole" (Alberti 2000a, 2011): the world "outside" and all interpreters' permanently changing information states. ℜeALIS thus can be formally defined by simultaneous recursion as an epistemic multi-agent system (Benz 2000) where "agents" get information about the world around them, including each other's minds (Á. Szeteli et al. 2023).

It would go far beyond the scope of the paper to provide and discuss the definition; but it is worth demonstrating the spirit of the mathematical technique of defining two or more sets by simultaneous recursion on two very simple sets. Two sets can be defined independently of each other by means of properties (5a–c). 'Be even' is a property according to which one can define the set of even numbers, marked by S in (5a); and via the property 'be odd', the set of odd numbers can be defined, marked by S' in (5a). As illustrated in (5b), it can also be regarded as a property that a function of "such numbers" are members of a known set. In the given case, the known set is the set S of even numbers, and the definition of the set S' of odd numbers is based upon set S.

(5)   **Different mathematical techniques of defining a pair {S, S'} of sets:**
       (a–c) by restricting properties
       (d–e) by simultaneous recursion

a. $S = \{n \in \mathbf{N}: n \text{ is even}\}$
      $S' = \{n \in \mathbf{N}: n \text{ is odd}\}$
      Calculation: $S = \{0, 2, 4, \ldots\}$; $S' = \{1, 3, 5, \ldots\}$

b. $S = \{n \in \mathbf{N}: n \text{ is even}\}$
      $S' = \{n \in \mathbf{N}: n{-}1 \in S\}$
      Calculation: $S = \{0, 2, 4, \ldots\} \to 1 \in S'$; $S = \{0, 2, 4, \ldots\} \to 3 \in S'$; $S = \{0, 2, 4, \ldots\} \to 5 \in S'$; $\ldots$

c. $S = \{n \in \mathbf{N}: n{+}1 \in S'\}$
      $S' = \{n \in \mathbf{N}: n{-}1 \in S\}$
      Calculation: ???

d. $S = \{n \in \mathbf{N}: 0 \in S, \text{ and } n{-}1 \in S'\}$
      $S' = \{n \in \mathbf{N}: n{-}1 \in S\}$
      Calculation: $0 \in S \to 1 \in S' \to 2 \in S \to 3 \in S' \to 4 \in S \to 5 \in S' \to \ldots$

e. $S = \{n \in \mathbf{N}: 0 \in S, \text{ and } n{-}1 \in S''\}$
      $S' = \{n \in \mathbf{N}: n{-}1 \in S\}$
      $S'' = \{n \in \mathbf{N}: n{-}1 \in S'\}$
      Calculation: $0 \in S \to 1 \in S' \to 2 \in S'' \to 3 \in S \to 4 \in S' \to 5 \in S'' \to \ldots$

An unsuccessful attempt to define the same two sets are presented in (5c). The problem is that S is attempted to be defined on the basis of S', and S', on the basis of S. It is for this type of problem that the Janus-faced nature of DRSs, discussed above, has been regarded as potentially presenting a major meta-theoretical risk. There is, however, a technique of defining two sets on the basis of each other, as demonstrated in (5d). Nothing else is required than providing even a single "initial" member of one of the sets, and this will "initialize", that is, starts the production of members in both sets in turn. It is zero in (5d) that is declared to be a member of S; on the basis of which 1 is defined to be a member of S'. Then a member of S is defined: 2; on the basis of which, again, a member of S' is defined, and so on, and so on.

The method of defining sets by simultaneous recursion can be extended to several sets. In (5e), S will be the set of natural numbers that can be divided by three as, from 0, one can return to this set three steps later. Set S' then consists of the numbers one greater than those dividable by three, and S" the numbers two greater than those dividable by three.

It is plausible to assume that it is essentially in this way that human minds get information from outside and then give information to each other and the world outside, and so on in infinite cycles.

4. DIFFERENT APPROACHES TO COMPOSITIONALITY

This section is devoted to another central topic of dynamic semantics: *compositionality*. "Compositionality is defined as the property that the meaning of a whole is a function of the meaning of its parts (cf. e.g., Keenan & Faltz 1985, 24–25)" (Zadrozny 1994, 329).

This standard definition has been questioned from the nineties (Zadrozny 1994, 329): "any semantics can be encoded as a compositional semantics, which means that, essentially,

the standard definition of compositionality is formally vacuous". Zadrozny (1994, 340–341) claims "that the property that the meaning of the whole is a function of the meanings of its parts does not put any material constraints on syntax or semantics".

> More formally [p. 330], the question is whether after deciding what sentences and their parts mean, we can find a function that would compose the meaning of a whole from the meanings of its parts. / The answer to this question is somewhat disturbing. It turns out that whatever we decide that some language expressions should mean, it is always possible to produce a function that would give a compositional semantics to it. … The upshot is that compositionality, as commonly defined, is not a strong constraint on a semantic theory.

In the light of this, we would like to make some remarks concerning the evaluation of the ontology of $\Re$eALIS (section 3) on the basis of the theoretical apparatus proposed by Kálmán (1994) and Kálmán, Kurucz & Szabó (2004). We also touch upon such fundamental theoretical questions as the Fregean *function–argument metaphor* (Frege 1984), *additivity* (Kálmán 1994), *uniformity / independency* (Kálmán, Kurucz & Szabó 2004 / Kálmán 1994), *instantiation* (Kálmán 1994), *total lexicalism*, the *autonomy of syntax* (Chomsky 1957), and *generativity* (Chomsky 1957; Kálmán, László & Miklós 2003).

Kálmán, Kurucz & Szabó (2004, 95–99) point to the historical fact that the traditional concept of compositionality relies on the Fregean function/argument approach to natural language meanings:

> Ever since Frege's pioneering work in the formal (logical) representation of natural language meanings (cf. Frege 1984), the idea of the parallelism of grammatical and semantic structure prevails. In particular, it is assumed that a grammatical structure "lacking" some element (e.g., a transitive verb without a direct object, or a predicate without a subject) must correspond to a semantic entity "lacking" something, namely, a function expecting an argument. … The cornerstones of the Fregean approach to the linguistic and semantic structures are the distinction between "complete" and "incomplete" expressions and meanings, on the one hand, and the assumption that these two are entirely parallel, on the other: Whatever is linguistically complete (incomplete) is also semantically complete (incomplete). … The Fregean parallelism between linguistic and semantic "completeness" underlies one of the most important methodological principles of modern semantics, namely, compositionality. … In our view, the principle of compositionality is indeed of utmost importance for natural language semantics in that it carves out that aspect of natural language use that can and is to be dealt with successfully by semantics. Compositionality means that the only phenomena that legitimately can be termed semantic must exhibit a systematic correspondence between form and meaning. … However, it is not clear to us why it should imply a parallelism between linguistic and semantic "completeness", if the term 'completeness' makes sense at all. Compositionality (fortunately) contains no stipulation to the effect that all aspects of linguistic form must be explained by a parallelism with meaning …, therefore it allows linguistic "completeness" to be a phenomenon independent of meaning.

The authors argue that

> we can safely assume that the linguistic distinction between "incompleteness" and "completeness" is a primarily linguistic, rather than semantic issue, although, as many other linguistic phenomena, may correlate with or be motivated by semantic factors. … We are convinced that compositionality does not impose anything on us with respect to "completeness", even though its historical origin is tightly related to that idea. In this sense, we believe compositionality should be understood in a

weaker sense than it usually is. On the other hand, we also think compositionality should be strengthened from another point of view. The principle that "the meaning of a complex expression is a function of its structure and the meanings of its constituents" imposes no serious restriction on compositional meaning assignment, for it says nothing on what 'meanings' and 'structures' are. … Using the term 'function' in the definition of compositionality is also very permissive. There is nothing a 'function' cannot do; therefore, under the traditional, weak definition of compositionality one would expect very unusual ways of combining meanings … [G]enuine compositionality requires a certain "*additivity*" of meanings that the function/argument approach does not guarantee, anyway.

Obviously, what one would expect from a compositional combination function is that it should be uniform in that it is always the same irrespective of what meanings it combines (this *uniformity* seems to coincide with the concept of *independency*, proposed in Kálmán's 1994 paper), and that it should preserve the meanings that it combines (i.e., it must not be destructive). These two requirements together suggest an essentially additive operation … [which] means that the value that it yields (i) is richer than either one of its operands in terms of information content; (ii) contains only information originating from one of the operands. … [T]his, in turn, presupposes that we are able to compare arbitrary meanings (both the ones to be combined and the resulting value) in terms of information content. A sufficient (and under certain reasonable assumptions, necessary) condition for this to be feasible is that our semantics must be *type free* (i.e., all meanings must be of the same type).

In $\mathfrak{R}$eALIS, as sketched in section 2, it is relation α that is responsible for the connection between form (syntax and morphology) and meaning; see Figures 2 and 4. As for *compositionality*, on the side of forms, words/morphemes look for each other on the basis of the lexical description on their "environmental requirements" (due to what is called 'incompleteness' above), and along with each successful step of unification, the corresponding two elementary DRSs are also unified on the semantic side. The rows of propositions are added to each other, and identity (α) and accessibility (λ) relations are formed between certain referents in these condition rows under the control of the lexicon – monotonically extending these two relations in the interpreter's information state. As proposition rows are also defined as a relation (σ), we can say that all three relations in the definition of information states will increase monotonically in the course of each step of syntactic construction (yielding meaning representations which are of the same type at each step). The grammar of $\mathfrak{R}$eALIS thus satisfies the strong version of compositionality based on the property of *additivity* in the sense defined by Kálmán, Kurucz & Szabó (2004). As for *uniformity / independency*, each activated lexical item feeds its invariable content into the gradually increasing common DRS; hence, this property is also satisfied in the reasonable sense explained in an earlier paper by Kálmán (1994, 4.2).

One might think that uniformity/independency prohibits the kind of interaction between lexical items that contribute new meaning elements and/or specifies their joint meaning depending on each other, referred to as *instantiation* by Kálmán (1994, 18); see a few basic types of example below. Kálmán (1994, 17–18) argues against a judgment like this: "Additivity [only] requires the pre-processing operations to be non-destructive".

The instantiation mechanism has nothing to do with Independence, which only constrains the context-dependency of meaning assignment. So the instantiation of meanings is free to be sensitive

to the internal context. That is, a strongly compositional analyis of 'productive ambiguities' … would be feasible if only we could do it in terms of this kind of mechanism.[13]

We claim that the required mechanism can be carried out in $\mathfrak{Re}$ALIS due to its representationalism (different sorts of referents can be retrieved), lifelong character (many sorts of accumulated knowledge can be exploited, and new/temporary meanings can be defined), and the technique of decomposition (the underspecified basic representation makes it possible to form different identity-classes among referents).

(6) **Illustration of *instantiation* (Kálmán 1994, 4.2)**

   a.   *pink apple / grapefruit* (Partee 1984a)[14]
   1.   'an apple which is pink on the outside':
   2.   apple r_1, pink r_2, $r_2 = r_1$???
   3.   actual meaning: apple r_1, pink r_2, outside r_3 r_1, $r_3 = r_2$
   4.   lexical meaning: apple r_1, $pink_2$ r_2, $r_2 = r_1$, where $pink_2$: 'pink on the outside'
   1'. 'a grapefruit which is pink on the inside':
   2'. grapefruit r_1, pink r_2, $r_2 = r_1$???
   3'. actual meaning: grapefruit r_1, pink r_2, inside r_3 r_1, $r_3 = r_2$
   4'. lexical meaning: grapefruit r_1, $pink_3$ r_2, $r_2 = r_1$, where $pink_3$: 'pink on the inside'

   b.   *quick coffee* (Kálmán 1994, 4.2)
   1.   'a coffee prepared / consumed/… quickly':
   2.   coffee r_1, quick r_2, $r_2 = r_1$???
   3.   coffee r_1, quick r_2, e_1: prepare r_3 r_4, e_2: consume r_5 r_6, $e_1 = r_2$ / $e_2 = r_2$
   4.   'prepared quickly': $quick_1$ r_1; 'consumed quickly': $quick_2$ r_1

   c.   Ad-d már ide az-t a rohadt / kurva / … vonalzó-t!!! (Hungarian)
        give-IMP-2SG already here that-ACC the rotten / whore ruler-ACC
        'Pass me that ruler!!!'
   1.   ruler r_1, rotten r_2, e: t give r_{you} r_I r_3, …, $r_2 = r_1$???
   2.   ruler r_1, rotten r_2, e: t give r_{you} r_I r_3, …, $r_2 = r_{you}$?
   3.   ruler r_1, e_1: angry r_I r_{you} e_2, e: t give r_{you} r_I r_3, …, $r_2 = r_{you}$

---

[13]Kálmán (1994, 17) describes the phenomenon as follows:

> What the examples in [(6a–b)] show, then, is that natural language meanings can be combined in more than one way, and how exactly the hearer is supposed to proceed is often left *implicit* by the speaker. Both the fact that competent speakers can produce equivalent, more explicit paraphrases and the fact that the actual choice of the paraphrase is not entirely determined indicate that the processes involved are similar to other cases related to implicit information. For example, it is usually left implicit why two sentences are put one after the other in a piece of discourse … In sum, the process … involves something very similar to certain *discourse* processes in which the speaker expects the hearer to establish "missing links" such as anaphoric and rhetorical relations. / This suggests that combining the meanings of natural-language expressions may involve more than the simple "intersection" operation … The meanings assigned to the constituents of such expressions are processed and brought into harmony with each other before "intersecting" them.

[14]"The adjective usually modifies a relevant part of what the noun denotes, as in *pink grapefruit* 'pink on the inside' vs. *pink apple* 'pink on the outside' …" (Kálmán 1994, 19).

First let us consider the underspecified representation in (6a.2). A phrase structure grammar would inescapably suggest the "intersective" solution: what is called an apple is claimed to be pink ($r_2 = r_1$). One might think that this connection is all right but the case of the grapefruit (6a.1') clearly shows that there is some problem: the grapefruit is pink "in another sense" (6a.1, 1'). The difference cannot be accounted for by the essentially equal representations demonstrated in (6a.2, 2'). This task requires trivial extensions, which supply the pieces of information that fruits have (relevant) parts. The extended representations (6a.3, 3') can already provide referents that can be identified with the referent whose predicate peg is *pink*, i.e., r_2. It can be said that we have obtained the "actual meanings" (see Alberti 2000b on "actual" and "lexical" meaning), obviously with the aid of our cultural/encyclopedic knowledge: the skin of the apple / the pulp of the grapefruit is pink.

By storing an actual meaning in the lifelong mind representation, a new lexical meaning is created based on an earlier lexical meaning. In the particular case, we have two new meanings, $pink_2$ ('pink on the outside') and $pink_3$ ('pink on the inside') It is shown in (6a.4, 4') that if these lexical items are at somebody's disposal, they can associate an "intersective" interpretation with the given expressions (*pink apple / grapefruit*). How can it be decided whether a given meaning is 'actual' or 'lexical'? The answer can be regarded as depending on interpreters: when they first come across with a meaning, it is necessarily an 'actual' meaning, and then, perhaps promptly after this first "meeting" or later, after many "meetings", they can store it, requalifying it as a lexical meaning by this action.

In a highly representationalist theory like $\mathfrak{R}$eALIS, the example shown in (5b) can be accounted for essentially in the same way as above. The decisive factor of the analysis is the trivial extension enriching the information state with a piece of information concerning the preparation / consumption of coffee.[15] Its eventuality peg can then play the role of what is quick (6b.3). Lexicalization can also plausibly defined here (6b.4).

An extreme case is presented in (6c) as the adjective immediately preceding the noun cannot be understood as providing the characterization of the denotatum of the noun, that is, the ruler (6c.1). The bad words should rather concern the subject, who is ordered to give a ruler to the speaker: this version of interpretation is formulated in (6c.2). It is possible to formulate a more precise version: the bad word does not relate to the subject directly but it is rather intended to express the speaker's momentary (negative) feelings towards them (6c.3). A preferred reading is that the speaker is *angry* with the hearer about something in connection with the eventuality of passing a ruler, which (eventuality e_2) is likely to be the fact that the hearer has not passed the speaker the ruler yet.

Let us now return to the Fregean basis of compositionality. The $\mathfrak{R}$eALIS approach follows Kálmán in assuming that syntactic incompleteness need not be truly reflected in the semantic representation (as incompleteness). This approach inherently has recourse to the radical separation of the two representations in this respect: every syntactic element in a sentence (except for elements of the small class of words constituting a sentence on its own) is qualified as incomplete (and "to be completed", due to their lexical environmental requirements) and every

---

[15]"… nouns referring to food quite often take modifiers that refer to their preparation or consumption … If, however, we assigned the meanings 'quickly prepared' or 'quickly consumed' to *quick* in [(6b) above] …, we would violate Independence. It is also clear that we would "miss generalizations" if we were to treat these ambiguities … as accidental surface coincidences (homonymy)" (Kálmán 1994, 17). Note that this latter argument is the same as that by which Pustejovsky (1995) argues in favor of his *Qualia Structure*.

corresponding semantic unit as complete. What have been referred to above as proto-DRSs are not incomplete; the only "problem" with this level of representation is that it does not express the full content of the given sentence. The semantics of $\Re$eALIS is also *type free* in the sense mentioned above: such sets of proposition rows as those illustrated in Figures 2 and 4 are added to each other / the given information state, yielding a same-type bigger set of proposition rows, which is a new information state. Identity and accessibility between referents are defined as relations, which are also *sets* (of pairs) *per definitionem*, so if it turns out that two referents are identical (α) or stand in a certain accessibility relation (λ), sets should be enlarged by adding sets to each other. Further, all the three relations that information states are based on (relations σ, α, and λ) are sets whose subsets are all can be regarded as well-formed relations of the same sort.

Note that the principle of the *autonomy of syntax* (Chomsky 1957) is satisfied in this approach in an interesting sense. Not in the sense that there is a separate, primary syntactic module whose output representations serve as the input to a semantic component which can convert certain pieces of the input data and construct a semantic representation from them. But in the sense that the composition of pairs of lexical items depends exclusively on their syntactic sides, as the proto-DRSs on the semantic side can always be put together (i.e., there are no incompatible units in the proto-DRS-based semantics).

Even in this latter sense syntax can be regarded as the *generative* component of the whole system of grammar. This latter thought means not only that syntax is the "motor" of grammar (i.e., the power that keeps the process of interpretation moving is that incomplete elements should be completed), but that a language can be defined in an abstract mathematical sense as the infinite set of sequences of lexical items that can be *generated* by the given set of combining rules.

This syntax-based *fundamentum*, surprisingly, is referred to in the following quotation by Chomsky himself as an obsolete stance of Chomsky the linguist's, instead of which Chomsky the philosopher is going to take a "language-of-thought"-based position – which is the inherent stance of mind-representationalist theories:

> [T]he Basic Property [of human language/communication] is not exactly as I formulated it before, and as it is formulated in recent literature – papers of mine, too. Rather, the Basic Property is generation of an unbounded array of hierarchically structured expressions mapping to the conceptual-intentional interface, providing a kind of "language of thought". (Chomsky 2016, 13)

The necessity of the principle of *generativity*[16] is also questioned by Kálmán, László & Miklós (2003), by raising an alternative according to which checking the wellformedness of sequences of words is not an integral part of the whole process of "working up" linguistic impulses ultimately yielding the interpretation. We do not agree with this alternative, and not only due to the aforementioned role of syntax as the "motor" of the dynamic interpretation of a linguistic impulse.

First, *wellformedness* is a relevant piece of data, in addition to the data provided by the external morphemes. Let us consider a mathematical analogy: constructing an arbitrary triangle requires three pieces of data, whilst constructing a *regular* triangle requires only one piece of data. Knowing that a triangle is regular, thus, is worth of two pieces of data.

---

[16]"A konstrukciós nyelvtan [(Kálmán 2001)] legfőbb elve ugyanis az, hogy az embereknek nem azt a képességét kell megmagyarázni, hogy különbséget tudnak tenni helyes és helytelen mondatok között *(már az is kérdéses, hogy rendelkeznek-e egyáltalán ezzel a képességgel)*, hanem azt, hogy bizonyos jelentéstípusok és formatípusok közötti kapcsolatok ismeretében képesek egymással kommunikálni" (Kálmán, László & Miklós 2003, 112).

Second, humans get a sentence as an external impulse, which should be observed by pure perception. In a typical non-linguistic situation, pure perception is such that every interpreter observes different things; it cannot be known what is to be observed, and if a detail has been ignored, it will not be looked for later because its absence is not known. The principle requiring wellformedness may make linguistic interpretation much more effective, because interpreters should look for the details until they have managed to "prove" that what they have heard is morphosyntactically well-formed. Even the slightest detail cannot be ignored – which might prove to be crucial in the course of the semantic phase of the process of interpretation. The principle that demands wellformedness is thus not a "bureaucratic prescription" but the key to effective interpretation.

5. STUBBORN PROBLEMS CONCERNING INTERSENTENTIAL COHESION: BRIDGING, AMBIGUITY, DEFERRED INFORMATION

Section 2 of Kamp et al.'s (2011) paper, whose title is "A dynamic and representational account of meaning", formulates the place and importance of phenomena concerning intra- and inter-sentential cohesion as follows:

> Traditionally, formal approaches to natural language semantics have focused on individual sentences and tried to explicate meaning in terms of truth conditions. Nevertheless it had long been acknowledged that content and context are closely related and in fact strongly determine each other. This is nowhere more evident than in the case of multi-sentence natural language texts and discourses which can constitute highly structured objects with a considerable amount of inter- and intrasentential cohesion. Much of this cohesion can be traced back to anaphoric properties of natural language expressions, that is, their capacity to refer back to (or point forward to) other expressions in the text. Pronominals and tense are but two examples of anaphoric devices – devices whose anaphoric nature was realised many years ago but which, it turned out, were difficult to capture with the machinery available within formal semantics in the 60's and 70's.

These "multi-sentence natural language texts" are assigned the peculiar Discourse Representation Structures, illustrated in section 2. DRSs had been invented to capture a "considerable amount of inter- and intrasentential cohesion". This shift in the basic unit of interpretation was a seminal development but we follow ℜeALIS in being convinced that a further step should be taken by declaring that the primary unit that a DRS-like representation is to be assigned is not the discourse but the interpreter's information state. In what follows, we present arguments in favor of assigning DRS-like representations to information states, and not (only/primarily) discourses.

5.1. Wedding ceremonies typically with ministers speaking very harshly and sometimes with dogs barking very loudly

The examples below concern the question of the "range" of intersentential cohesion. This range is undoubtedly beyond the boundaries of individual sentences; but where are the upper boundaries?

The personal pronoun *he* in (7b) is a representative of the usual argument for the presence of intersentential cohesion between elements in different sentences (*my brother* and *he*), that is, inside a multisentential discourse (7a+b). In this case, thus, a two-sentence discourse can be regarded as the range of cohesion. As for formal details, *he* is a definite pronoun, which, as well

as definite expressions generally, introduces a referent in the corresponding DRS with the demand that this referent should be unificated with a salient referent in the local "box" of the DRS in question; see section 2 and the relation x"→x' in (7b).[17]

(7)   **Illustration of the range of intersentential cohesion**
  a.   My brother got married yesterday.[18]
        {x brother of i; got_married x'; x→x'; …}
  b.   … *He* looked very happy.
        {male x"; x"→x'; …}
  c.   … *The minister* spoke very harshly.
        {minister y; spoke y'; y→y'; y→?}
  d.   … ?*The dog* barked very loudly.
        {dog y; barked y'; y→y'; y→?}
  e.   My uncle got married. He was officiated by a very old minister.
        {got_married u; …;
        male u'; u'→u; z officiated u"; u'→u";
        minister z'; z'→z; …}
        DISTANCE(GET_MARRIED, BE_A_MINISTER) = 2
  f.   (a)+(c)+(e): {got_married x; z officiated x; minister z; …}
  g.   My brother owns a dog. It barks very loudly when it feels that he is getting in trouble.
        {u brother of i; dog z; u' owns z'; u→u'; z→z'; …}
        DISTANCE(BE_SOMEONE'S BROTHER, BE_A_DOG) = 2
  h.   (a)+(d)+(g): [My brother got married yesterday. His dog barked very loudly. It may have felt that he was going to get in trouble.]

Let us now compare the felicitous discourse in (7a+c) to the infelicitous, or at least less felicitous, one in (7a+d); (a slightly different version of) which had served as a point of departure for Kálmán & Szabó's (1990, 125) D.I.R.T. The two-sentence text in (7a+c) suggests an "unbounded" range of cohesion: ideal interpreters should have recourse to certain pieces of cultural/encyclopedic knowledge concerning the religious methods of marriage in our "Western" civilization, which they could learn possibly in their childhood. What is relevant here is that in our culture a *minister* is a potential "distinguished participant" of a marriage whilst nothing similar holds true of a dog. Nevertheless, it is not excluded that an interpreter considers discourse (7a+d) to be more or less felicitous: what is needed is, say, a piece of interpersonal knowledge about a salient dog in the speaker's brother's life. It is also relevant that neither the minister in the former case, nor the dog in the latter case can be found in any kind of closure of the interpreter's information state under logical entailment (i.e., it is not obligatory to have a minister, or a dog, in the wedding ceremony as there *are* non-religious wedding ceremonies with no clergymen), so the cohesion holds between the present sentences and ones that had learned

---

[17]On the definition of *saliency* within DR Structures and the importance of information concerning *gender*, see Kamp (1981), Kamp & Reyle (1993), Kamp, Genabith & Reyle (2011), Alberti (2011), Alberti & Kleiber (2012, 1.3).

[18]The sentences in (7b–d) are intended to serve as alternative continuations of the sentence in (7a).

long ago, in an unbounded chronological distance. In a purely logical-content-based semantic approach, what legitimate explanations can be based upon are such relations among possible worlds as those according to which certain possible worlds entail or, to the opposite, exclude certain possible worlds. These approaches obviously do not have enough munitions for accounting for the type of phenomenon in question, inevitably resulting in a need for finding new ways in dynamic semantics (Kálmán & Szabó 1990).

Due to the unquestionable need for taking into account cultural/encyclopedic knowledge, on the one hand, and interpersonal knowledge, on the other, the natural basis of an exhaustive solution must be interpreters' mind representations. As human beings, this is the data base at our disposal while communicating (and acquiring facts of our environment). It is worth starting from another global question, that of *meaning*. In the case of a word, it is an oversimplification to speak about a definite meaning associated with it in some lexicon. We take the position, instead, essentially following Kálmán's (1990, 152) concept on deferred information, that each word, say, in a given sentence to be interpreted, initiates a process in the course of which pieces of information "stored" in the interpreter's information state appear in some "active(ated)" workspace of the mind; which can be imagined as a Kampian box or small complex of boxes. These "released" pieces of information due to the words (morphemes) of the given sentence should be built together to form a coherent unit in a well-defined sense, and it partly depends on the success of this ("global") process which ("local") word will release how much (and what kind of) information; the process partly depends on the interpreter's intentions, too. This approach promises a straightforward solution to puzzles concerning *bridging* phenomena (Kálmán 1990, 125; Asher & Lascarides 1998), so it is worth the inconvenience of speaking, in the case of a word (morpheme), about a "possible", or "ideal", or "expectable" (lexical) meaning instead of "the meaning", which simply expresses a false idealization of some kind of constant internal lexical component.

With all this in mind, let us overview the steps of our solution to the particular double problem with the minister and the dog, the formal details of which are presented in (7c–h). Rows (7c–d) show why the famous two-sentence discourses (7a+c) & (7a+d) are meant to be a stubborn challenge: for (the referents of) the definite noun phrases *the minister* and *the dog*, due to their being definite, appropriate antecedents should be found, but the speaker and the brother, the only two participants in the discourse, are not considered to serve as acceptable antecedents by any native speaker. In a mind representationalist approach, interpreters are plausibly assumed to have, in their minds, stories such as the one presented in (7e). The DRS of the uncle's religious wedding ceremony can then serve as a source of information concerning the potential connection between the predicates GET_MARRIED and BE_A_MINISTER. The obvious intuition that the two predicates are "close" to each other can be captured formally in ℜeALIS by means of relation α, marked by arrows in (7). We can say that the distance between two predicates is 1 if there are referents ξ and ξ' which (i) are unificated (ξ→ξ') and (ii) ξ forms a proposition with one of the predicates in the interpreter's lifelong DRS and ξ' with the other predicate. On the basis of DRS (7e), hence, the distance between GET_MARRIED and OFFICIATE is defined as 1, and that between OFFICIATE and BE_A_MINISTER is also defined as 1. The distance between two arbitrary predicates can then be defined as the length of the shortest α-chain between them. Discourse (7a+c) can be verified to be coherent – in a given DRS – because BE_A_MINISTER is close to GET_MARRIED; and the underlying DRS is relevant as the propositions of the distance-verifying chain can, and should, be inserted in the

incoherent union of DRS (7a) and DRS (7c), yielding the coherent DRS presented in (7f). Interpreters *commit* themselves to the truth of the information found and then inserted in the way described, as paraphased in D.I.R.T. In the particular case, thus, it is correctly predicted that legitimizing the definite expression in (7c) will come with realizing that the speaker's wedding ceremony has been a religious ceremony.

It is a crucial element of the definition of distance between predicates that the underlying relation α is a unidirectional relation, which is a set of pairs of referents that is a much smaller set than its closure, the equivalence relation of 'being identical' among referents (discussed in section 2). There might be lengthy stories about the old clergyman who performed the uncle's wedding ceremony in the story given in (7e). In these stories he might have eaten and drunk different things, climbed steep mountains, visited different people, etc. Had the definition above of distance been based upon the equivalence relation, the common participant in the corresponding propositions would have rendered the predicates in question to be uniformly 1 unit close to each other. Hence, it is of outstanding importance that relation α tends to build *rare* networks among pegs which otherwise belong to the same entity. In an antirepresentationalist approach only the logical content of sameness can be considered, that is, the equivalence relation (NB: in a representationalist approach, it is easy to capture the equivalence relation as it is simply the commutative-transitive closure of the unidirectional relation α).

As for *the dog* in (7a+d), we would like to state simply that the distance between BE_A-DOG and GET_MARRIED is great and hence the given two-sentence discourse is much less felicitous then the version with the minister. But the question is much more complex.

First of all, different interpreters can have significantly different experiences about wedding ceremonies. Suppose there is a particular dog living in the neighborhood of a church that is famous for barking very loudly when there is a wedding ceremony in the church with a bridal couple the magic dog feels incompatible. With this story in their minds, certain interpreters may construe (7a+d) as being as coherent as (7a+c). The mind-based definition sketched above predicts exactly this – that some will understand the discourse in (7a+d) while others will not – which can be regarded as a desirable result.

Second, it is an advantegous feature of the representation-based definition of distance between predicates that, besides the shortest α-chain, other chains can also be taken into consideration. It is also possible that there are many α-chains of the same length in mind representations. It is presumable that there will be a high number of short α-chains between BE_A-MINISTER and GET_MARRIED with significantly lesser α-chains between BE_A_DOG and GET_MARRIED, at least in most minds, as a reflection of the intuition that the connection between marriages and ministers belongs to our cultural/encyclopedic knowledge while that between dogs and marriages is accidental and its instances belong to interpreters' interpersonal knowledge.

Third, we can also attempt to base the coherence of (7a+d) upon some connection between dogs and brothers, or dogs and the particular person claimed in (7a) to have got married (7a + d, g, h). Obviously, numerous pieces of interpersonal knowledge in lifelong DRSs will provide α-chains in the case of both connections in question. The question of *unicity* can be raised at this point (section 2), in the following generalized form: of the α-chains connecting two predicates to be investigated, is there a chain through certain predicates the occurrence of which is outstandingly more frequent than that of the competing chains, or there is no outstanding chain. Although clergymen can also be guests in wedding ceremonies, it is likely that in a lifelong

DRS there are much more stories about clergymen performing wedding ceremonies than clergymen playing there the role of guests. Brothers or dogs, however, are likely to participate in wedding ceremonies with patterns of alternative types of chain with no unique outstanding chain type.

Fourth, the distinction between cultural/encyclopedic and semantic knowledge may be distinguished in a mind-representationalist approach the model of which contains, as a single uniform system, the representation of the information content of the "world outside" together with the representations of all minds. ℜeALIS is defined in this way (Alberti 2011), in order to make it possible to capture *out-anchoring*: the referential connection between a peg in a mind and the entity in the world outside whose (some kind of) impulse has activated the given peg. Leiss (2014) differentiates, in a mind, a semantic memory, responsible for storing knowledge, and an episodic memory, which stores experiences.[19] Ministers, brothers and wedding ceremonies in interpreters' episodic memory may be differentiated from ministers, brothers and wedding ceremonies in the semantic memory on the basis of whether their pegs (or more precisely, the α-closure equivalence classes of their pegs) are out-anchored, or not. Interpersonal knowledge essentially pertains to definite persons, things or animals, which are thus inhabitants of the episodic memory out-anchored to entities in the real world. Cultural/encyclopedic knowledge is obviously stored in the semantic memory and is about no particular persons, animals or things but provide information on species and types. In ℜeALIS, the semantic memory can be assumed to be permanently being fed by the episodic memory with DRSs coming from the episodic memory converted by (partially) "cutting" their out-anchors (in this way, a story about definite participants can be converted into a general wisdom on "such" persons or things). Therefore, on the basis of out-anchoring, it is possible to account for the difference between instances of coherence based on cultural/encyclopedic knowledge (7a + c, e, f) and on interpersonal knowledge (7a + d, g, h).

All in all, different intuition-based solutions can be proposed for different types of bridging phenomena, which all exploit the construal of mind representation as a lifelong DRS.

---

[19] Leiss (2014) distinguishes two parts of long-term memory on the basis of Tulving's (2005) research as follows: "the semantic memory stores knowledge, whereas the episodic memory stores experiences". / The author characterizes the differences as follows: in contrast to semantic knowledge, episodic knowledge has space-time-index quality, because experience characteristically takes place in space and time, and consequently the respective space-time coordinates are mapped. The construction of episodic memory typically correlates with the acquisition of finite sentences, which, in turn, correlates with the use of inflected verbs. The function of finite sentences is to establish a reference by anchoring concepts to a space-time context. Without this technical device, autobiographical memories would not be possible. Space-time coordinates are constituted by the ATMM-complex: by the aspect-coded space coordinates, by the time-coded tense coordinates, by mood coordinates that signal *irrealis* (i.e., statement not anchored in reality) versus *realis* in the sense of Carnap, and by the coordinates of the source of evidence the speaker relies on. The download of episodic experience by virtue of the grammatical categories aspect, tense, mood, and modality enables us to orient ourselves in the real world. These categories generate a system of coordinates that anchors our activities in the world, and which, in turn, provides indices for our memories, thereby makes them memorizable. The very difference between semantic memory and episodic memory consists of the fact that experiences are based on the first person, whereas knowledge is based on the intersubjectification of first-person experiences. Intersubjectification implies the neutralization of space-time coordinates, thus generating knowledge. Subjective certainty, and the download of this type of certainty, is achieved by virtue of the grammatical ATMM-categories. Here the functions of language are essential for gaining reference to the world. Objective certainty will be achieved by the never-ending construction of an intersubjectively negotiated lexicon.

5.2. Unicorns unpacked

Examples (8c, f, g, h) illustrate Kálmán's (1990, 3.2.3) anti-mainstream position that what is typically qualified as scope ambiguity – see the "inverse scope" in (8d) *versus* the "straight scope" in (8b) – should rather be analyzed by relying on *monotonically* extending information states. That is, one reading should be construed as a further specified variant of the other reading in the cases in question.

(8)   **Ambiguity or Deferring Information?**
  a.   Every farmer saw a unicorn
  b.   'For each farmer there is a unicorn that he saw.' (representation: see Figure 4 in
        section 1)
        e0: e1⇒e2, e1: farmer x, e2: e21&e22, e21: x' saw y', e22: unicorn y
        x→x', y→y'
        e0 < [e1, x] < [e2, e21, e22, x', y', y]
  c.   Every farmer saw a unicorn. *It* was white.
  d.   'There is a unicorn seen by every farmer. It was white.'
  e.   'For each farmer there is a unicorn that he saw. The same one, and it was white.'
        e0: e1⇒e2, e1: farmer x, e2: e21&e22, e21: x' saw y', e22: unicorn y, **white y"**
        x→x', y→y', **y"→y**
        [e0, **y"**] < [e1, x] < [e2, e21, e22, x', y', y]
  f.   I am looking for a piano. *That big black Bösendorfer.*
  g.   Every farmer was killed. *The murderer* is still at large.
  h.   Every farmer was sued. *The trial* will be held tomorrow.

The pair of decomposed DRSs provided in (8b, e) illustrates an analysis that is the realization of Kálmán's (1990, 149, (i–iii)) concept of *unpacking* in the ℜeALIS formalism. DRS (8e) is obviously a monotonic extension of DRS (8b) since the former is created by simply adding the sequences of symbols written in bold letters to the latter.

Let us consider the relevant details. As illustrated in Figure 4 by the formula [e0: e1⇒e2], *every* is essentially an alternative expression of an 'if … then'-construction: 'if we consider a farmer (available in the given context) then he can be claimed to have seen a unicorn'. Note that purely by the relations themselves presented in (8b) it has not been definitively decided whether there are several unicorns or there happens to be a single shared one. As the latter reading is very special, the former one is to be highly preferred on Grice's (1975) Maxim of Quantity (according to which one tries to be as informative as one possibly can, and gives as much information as is needed, and no more). Nevertheless, the appearance of the single pronoun in the second sentence in the two-sentence discourse in (8d) provides no contradiction. Its contribution is to be regarded as a *monotonic* but not *trivial* extension of the corresponding information state. It provides a piece of *extra* information, exactly that claimed to be required by the Gricean maxim referred to above; and our decomposition-based solution presented in (8e) is the most direct reflection of this construal. The sequences of symbols in bold letters mean that the peg of 'what is white', y", is unificated with the peg of unicorn(s), which is positioned in the wordlet of the conclusion e2, but peg y" is positioned on the basic level of eventuality-peg e0, called the *root worldlet* in ℜeALIS (Alberti 2011), in harmony with its linguistic source (the pronoun *it* is a

single definite expression). One might think at this point that α-unified pegs being associated with different λ-levels mean some sort of contradiction, but that is not the case. In discourse (8f), for instance, 'finding a piano' is an event that belongs to the possible world of wishes and within this wish the piano itself may also belong to the wish (called the *de dicto* interpretation) but may also be a particular one in the real world (*de re* interpretation) (Karttunen 1976). In ℜeALIS (Alberti 2011), the ("intensional") λ-level of an equivalence class of α-unified pegs is defined as the λ-level of the peg in the class that is closest to the basic λ-level in the partial order realized by relation λ.[20]

Examples (8g–h), which are due to Kálmán (1990, 153, (27–28)), are further illustrations of definite singular pronouns providing extra information in the deferred manner discussed in this subsection. As finding their antecedents obviously requires bridging, the analysis of the given examples should rely on the union of the decomposition-based techniques presented in the two subsections 4.1 and 4.2; with the key step of attributing the pegs associated with *the murderer* and *the trial* after bridging to the λ-level of the root worldlet in interpreters' information states).

6. CONCLUSION AND LOOSE ENDS

The paper reconsiders such central but dubious, or at least debated, constituents and concepts of dynamic semantics as discourse representation, compositionality, and different forms of inter-sentential cohesion, largely following László Kálmán and his colleagues' generally radical anti-mainstream trains of thoughts.

Section 2 provides a rich illustration of different types of discourse and mind/mental-state representation.

Section 3 concentrates on such crucial metatheoretical questions concerning discourse representation as their alleged illegitimacy as a superfluous "extra level" of representation and their Janus-faced status in semantics description. We argue that discourse representationalism should neither be eliminated (Groenendijk & Stokhof 1990, 1991) nor be reduced to a minimum (Dekker 2000): instead of eliminating the "extra level", the "extra-level problem" should be eliminated, by means of a novel ontology for dynamic pragmasemantics, proposed in the ℜeALIS approach (Alberti 2011; Alberti & Kleiber 2012, 2014). The desirable ontology should be such that the "extra level" be part of a level of representation the existence of which cannot be questioned. As for the problem of DRSs having a Janus-faced character (Kálmán & Rádai 2001, 82), the solution lies in a *simultaneously recursive definition* of "the whole model" (Alberti 2000a, 2011): ℜeALIS is formally defined by simultaneous recursion as an epistemic multi-agent system (Benz 2000) where "agents" get information about the world around them, including each other's minds (Á. Szeteli et al. 2023).

It is pointed out in section 4 that ℜeALIS avoids the problems of the standard function-based "Fregean" method along which compositionality is traditionally defined (Zadrozny 1994,

---

[20]A peg belonging to a "more intensional" λ-level than the λ-level-defining peg in their equivalence class of α-unification means that when interpreters are interpreting the very sentence that provides the given peg they either attribute, temporarily, a false intensional status to it, if the arrival of the λ-level-defining peg is "deferred" (Kálmán 1990; Kálmán & Szabó 1990), or have already been aware of the inevitable *de re* status of the available interpretation.

329; Kálmán 1994, 4.2; Kálmán, Kurucz & Szabó 2004, 95–99). We also present in this section a surprising quotation by Chomsky (2016, 13), in which he himself qualifies the standard syntax-based *fundamentum* of grammar (Chomsky 1957) as an obsolete stance of Chomsky the linguist's, instead of which Chomsky the philosopher ought to be going to take a "language-of-thought"-based position – which is the inherent stance of mind-representationalist theories.

Section 5 discusses two types of intersentential coherence. We argue that both bridging phenomena (Kálmán 1990; Kálmán & Szabó 1990, 125) and a monotonic solution to a basic type of scope ambiguity referred to as unpacking in Kálmán (1990, 3.2.3) require the decom-position-based discourse-representation-via-mind-representation approach that ℜeALIS (Alberti et al. 2019) provides.

As for future research, now we plan to scrutinize such special types of bridging as those illustrated in (9).

(9)   **Further phenomena that trigger bridging**
    a.   Implicit reference to *result state* (Farkas & Ohnmacht 2012, 353–356)
          'Stand up,' instructs the father his five-year-old son in the course of bathing him after a 15 minute period of the kid, seated in the water, playing with his rubber ducks. The kid is standing up but, instead of remaining standing, he is promptly sitting back, grinning at the father, who has not been able to soap him up.
    b.   *Vanni* and other -NI constructions (Kálmán 1999; Kleiber & Alberti 2014)
          A: Van pénzed?   B: *Vanni* van, de nem adok.
            is money-POSS2SG is-INF is but not give-1SG
          A: 'Do you have any money on you?' B: 'I do, but I won't give you any.'
    c.   Hungarian patterns of intonation that suggests implicit content (Varga 2016, 57)
          1. ˈElvitték a ˈvendégeket a ˋborfesztiválra.
          2. ˈElvitték   a ˈvendégeket a ˇborfesztiválra.
          away-take-3PL the guest-PL-ACC the wine-festival-SUB

The story presented in (9a) illustrates the question of felicity conditions of directives (Searle & Vanderveken 1985, 198–205). On the assumption that complex events are to be characterized by a tripartite structure that consists of a preparatory phase, a cumulative phrase, and a result phase (Farkas & Ohnmacht 2012, 353–356), the kid's joke can be analyzed as follows. He has been given an instruction and he has executed the cumulative phase of what has been asked for; but he has not remained in the result phase for a sufficient time (while he should have been soaped up). The accomplishment of directives (and commissives; see Searle & Vanderveken 1985, 192–198) can typically be evaluated on the basis of the procession of all the three phases referred to above. We consider this problem to belong to bridging phenomena because the three phases may be named by different lexical items to be found in the semantic memory via bridging techniques.

NI-constructions are illustrated in (9b), typically used in answers (Kálmán 1999; Kleiber & Alberti 2014). The answer suspects that the questioner's "true" intentions point to another question than that explicitly asked. Consequently, in the spirit of the Cooperative Principle (Grice 1975), the answerer's utterance should contain not only the answer to the original question but also to the assumed one. Only answering the original question would feel misleading. Thus, an answer with the NI-construction indicates that, although the eventuality

in question is true, some other – contextually relevant – eventuality is false; which should be made explicit, usually after a contrastive connector. The connection between the two eventualities is presumably the same as that between those in typical bridging connections.

Finally, even special patterns of intonation may suggest that, besides what has been explicitly said, something else has also been intended to be conveyed. Example (9c) is due to Varga (2016, 57), who claims that the meanings of (9c.1) and (9c.2) are cognitively identical, but they differ in the attitudes that their intonations convey. Intonation (9c.1) is regarded as standard: two contours with Half-Fall pattern is followed by a Full-Fall terminal contour. Intonation (9c.2) is different in its terminal contour, which is Fall-Rise. This terminal contour is claimed to signal some kind of conflict between the sentence and the contex. It may express the speaker's reservation (partial agreement, partial disagreement) over his/her interlocutor's previous remark, which could be for instance that the people mentioned did not treat their guests nicely enough. Or it may prepare the way for a (potential) conflicting continuation, which begins with the word *de* 'but', as in *De az egy katasztrófa volt* 'But that was a disaster'.

Such phenomena suggest that languages use a wide variety of formal means to indicate that the pieces of information that could be explicitly encoded mean only the first step towards the entire revelation of the message on the basis of our mind representations to be permanently built in unbounded cycles of simultaneous recursion.

REFERENCES

Alberti, Gábor. 2000a. Lifelong discourse representation structures. Gothenburg Papers in Computational Linguistics 00-5. 13–20.

Alberti, Gábor. 2000b. Jelentésleírás – „életfogytiglani" DRS-ben [Meaning representation – in a "lifelong" DRS]. In G. Tamás (ed.) Lexikális jelentés – aktuális jelentés [Lexical meaning – actual meaning]. Budapest: Tinta Kiadó. 12–25.

Alberti, Gábor. 2008. Situations and individuals by Paul D. Elbourne. Review article. Acta Linguistica Hungarica 55. 427–453.

Alberti, Gábor. 2011. ℜeALIS: Interpretálók a világban, világok az interpretálóban [Interpreters in the World, Worlds in the Interpreter]. Budapest: Akadémiai Kiadó.

Alberti, Gábor. 2012. Where are possible worlds? II: Pegs, DRSs, worldlets and reification. In G. Alberti, J. Farkas and J. Kleiber (eds.) Vonzásban és változásban [In attraction and in change]. Pécs: Doctoral School of Linguistics at the University of Pécs. 308–323.

Alberti, Gábor, Kata Balogh and Judit Kleiber. 2002. GeLexi project: Prolog implementation of a totally lexicalist grammar. In D. de Jongh, H. Zeevat and M. Nilsenova (eds.) Proceedings of the 3rd and 4th Tbilisi Symposium on Language, Logic and Computation. Amsterdam: ILLC & Tbilisi: Univ. of Tbilisi. yumpu. com/en/document/view/22606650/package-the-institute-for-logic-language-and-computation.

Alberti, Gábor, Kata Balogh, Judit Kleiber and Anita Viszket. 2003. Total lexicalism and GASGrammars: A direct way to semantics. In A. Gelbukh (ed.) Computational linguistics and intelligent text processing: 4th International Conference, CICLing 2003 (Lecture Notes in computer Science, Vol. 2588). Berlin & Heidelberg: Springer. https://doi.org/10.1007/3-540-36456-0_4.

Alberti, Gábor, Mónika Dóla, Eszter Kárpáti, Judit Kleiber, Anna Szeteli and Anita Viszket. 2019. Towards a cognitively viable linguistic representation. Argumentum 15. 62–80.

Alberti, Gábor and Judit Kleiber. 2004. The *GeLexi* MT project. In J. Hutchins (ed.) Proceedings of EAMT 2004 Workshop. Valletta: Foundation for International Studies, University of Malta. 1–10.

Alberti, Gábor and Judit Kleiber. 2010. The grammar of ℜeALIS and the implementation of its dynamic interpretation. Informatica 34(2). 103–110.

Alberti, Gábor and Judit Kleiber. 2012. Where are possible worlds? Arguments for ℜeALIS. Acta Linguistica Hungarica 59. 3–26.

Alberti, Gábor and Judit Kleiber. 2014. ℜeALIS: Discourse representation with a radically new ontology. In L. Veselovska and M. Janebova (eds.) Complex visibles out there (Olomouc Modern Language Series 4). Olomouc: Palacký University. 513–528.

Alberti, Gábor and László Nőthig. 2015. ℜeALIS2.1: The implementation of generalized intensional truth evaluation and expositive speech acts in on-going discourse. International Journal on Advances in Intelligent Systems 8(1-2). 85–106.

Alberti, Gábor and Anna Szeteli. 2018. ℜeALIS: A mi kölcsönös és élethossziglani tudásunk [ℜeALIS: Our reciprocal and lifelong knowledge]. Iskolakultúra 28(5-6). 3–14.

Alberti, Gábor, Anna Szeteli, Judit Kleiber and Eszter Kárpáti. 2024. Mondattípus, illokúciós aktus, perlokúciós hatás – A kétrétegű dinamikus pragmaszemantika mint a klasszikus illokúciós logika továbbfejlesztése [Sentence type, illocutionary act, perlocutionary effect – Two-layered dynamic pragmasemantics as a development of the classical illocutionary logics]. Jelentés és Nyelvhasználat 11(1). 57–99.

Asher, Nicholas and Alex Lascarides. 1998. Bridging. Journal of Semantics 15. 83–113.

Asher, Nicholas and Alex Lascarides. 2003. Logics of conversation. Cambridge: Cambridge University Press.

Benz, Anton. 2000. Chains and the common ground. Gothenburg Papers in Computational Linguistics 00-5. 181–184.

Chomsky, Noam. 1957. Syntactic structures. The Hague: Mouton.

Chomsky, Noam. 2016. What kind of creatures are we? New York, NY: Columbia UP.

Dekker, Paul. 2000. Coreference and representationalism. In K. von Heusinger and U. Egli (eds.) Reference and anaphoric relations. Dordrecht: Kluwer. 287–310.

Dowty, David R., Robert E. Wall and Stanley Peters. 1981. Introduction to Montague semantics. Dordrecht: Reidel.

Elbourne, Paul. 2005. Situations and individuals. Cambridge, MA: MIT Press.

Farkas, Donka. 1993. Modal anchoring and noun phrase scope. Manuscript. U. of California at Santa Cruz, Santa Cruz, CA.

Farkas, Judit and Magdolna Ohnmacht. 2012. Aspect and eventuality structure in a representational dynamic semantics. In G. Alberti, J. Kleiber and J. Farkas (eds.) Vonzásban és változásban [In attraction and in change]. Pécs: Linguistics Doctoral School at the University of Pécs. 353–379.

Frege, Gottlob. 1984. On concept and object. In B. McGuiness (ed.) Collected papers on mathematics, logic, and philosophy. Oxford: Blackwell. 182–194.

Geurts, Bart, David I. Beaver and Emar Maier. 2023. Discourse representation theory. In E. N. Zalta and U. Nodelman (eds.) The Stanford encyclopedia of philosophy, Winter 2023 Edition. Standord, CA: The Metaphysics Research Lab, Philosophy Department, Stanford University. https://plato.stanford.edu/archives/win2023/entries/discourse-representation-theory/.

Grice, H. Paul. 1975. Logic and conversation. Syntax and Semantics 3: Speech Acts. New York, NY: Academic Press. 41–58.

Groenendijk, Jeroen and Martin Stokhof. 1990. Dynamic Montague grammar. In L. Kálmán and L. Pólos (eds.) Papers from the Second Symposium on Logic and Language. Budapest: Akadémiai Kiadó. 3–48.

Groenendijk, Jeroen and Martin Stokhof. 1991. Dynamic predicate logic. Linguistics and Philosophy 14. 39–100.

Groenendijk, Jeroen, Martin Stokhof and Frank Veltman. 1996. Coreference and modality. In S. Lappin (ed.) The handbook of contemporary semantic theory. Oxford: Blackwell. 179–213.

Kálmán, László. 1990. Deferred information: The semantics of commitment. In L. Kálmán and L. Pólos (eds.) Papers from the Second Symposium on Logic and Language. Budapest: Akadémiai Kiadó. 125–157.

Kálmán, László. 1994. Strong compositionality. Working Papers in the Theory of Grammar 2/3. Budapest: Theoretical Linguistics Programme, Budapest University (ELTE) & Research Institute for Linguistics, Hungarian Academy of Sciences; also appeared in Paul Dekker & Martin Stokhof (eds.). 1996. Proceedings of the 10th Amsterdam Colloquium. Amsterdam: ITLI, University of Amsterdam. 465–478.

Kálmán, László. 1999. Vanni [To be]. In L. Kálmán and N. Ádám (eds.) Hárompercesek a nyelvről [Three-minute talks about language]. Budapest: Osiris. 219–220.

Kálmán, László. 2001. Konstrukciós nyelvtan [Construction grammar]. Budapest: Tinta Könyvkiadó.

Kálmán, László, Balázs László and Erdélyi Szabó Miklós. 2003. Tudásalapú természetesnyelv-feldolgozás [Knowledge-based natural-language processing]. Magyar Számítógépes Nyelvészeti Konferencia (MSZNY 2003) [Conference on Hungarian Computational Linguistics]. Szeged: Deparment Group of Informatics, University of Szeged. 109–115.

Kálmán, László, Ági Kurucz and Miklós Erdélyi Szabó. 2004. Propositional logic for natural language semantics. In L. Hunyadi, G. Rákosi and E. Tóth (eds.) Preliminary papers of the Eighth Symposium on Logic and Language. Debrecen: University of Debrecen. 95–106.

Kálmán, László and Gábor Rádai. 2001. Dinamikus szemantika [Dynamic semantics]. Budapest: Osiris.

Kálmán, László and Zoltán Szabó. 1990. D.I.R.T.: An overview. In M. Stokhof and L. Torenvliet (eds.) Proceedings of the Seventh Amsterdam Colloquium. Amsterdam: ITLI, University of Amsterdam. 253–275.

Kamp, Hans. 1981. A theory of truth and semantic representation. In J. Groenendijk, T. Janssen and M. Stokhof (eds.) Formal methods in the study of language. Amsterdam: Math. Centre. 277–322.

Kamp, Hans. 1990. Prolegomena to a structural account of belief and other attitudes. In A. Anderson and J. Owens (eds.) Propositional attitudes: The role of content in logic, language, and mind. Stanford, CA: CSLI. 27–90.

Kamp, Hans and Ágnes Bende-Farkas. 2019. Epistemic specificity from a communication-theoretic perspective. Journal of Semantics 36. 1–51. https://doi.org/10.1093/jos/ffy005.

Kamp, Hans, Josef van Genabith and Uwe Reyle. 2011. Discourse representation theory. In D. Gabbay and F. Guenthner (eds.) Handbook of philosophical logic 15. Berlin: Springer. 125–394.

Kamp, Hans and Uwe Reyle. 1993. From discourse to logic. Dordrecht: Kluwer Academic Publishers.

Karttunen, Lauri. 1976. Discourse referents. In J. D. McCawley (ed.) Notes from the linguistic underground, syntax and semantics 7. New York, NY: Academic Press. 363–385.

Keenan, Edward L. and Leonard M. Faltz. 1985. Boolean semantics for natural language. Dordrecht: D. Reidel.

Kleiber, Judit. 2005. Across world(let)s in a representationalist dynamic semantics. In J. Gervain (ed.) Proceedings of the 10th ESSLLI Student Session. Edinburgh: ESSLLI. 112–121.

Kleiber, Judit and Gábor Alberti. 2014. Uncertainty in polar questions and certainty in answers? In S. Cantarini, W. Abraham and E. Leiss (eds.) Certainty-uncertainty – and the attitudinal space in between (Studies in Language Companion Series 165). Amsterdam: John Benjamins. 135–152. https://doi.org/10.1075/slcs.165.08kle.

Landman, Fred. 1986. Towards a theory of information. Dordrecht: Foris.

Lauer, Sven. 2013. Towards a dynamic pragmatics. Doctoral dissertation. University of Stanford, Stanford, CA.

Leiss, Elisabeth. 2014. Modes of modality in an Un-Cartesian framework. In S. Cantarini, W. Abraham and E. Leiss (eds.) Certainty–uncertainty – and the attitudinal space in between (Studies in Language Companion Series 165). Amsterdam: Benjamins. 47–62.

Maier, Emar. 2010. Presupposing acquaintance: A unified semantics for *de dicto, de re* and *de se* belief reports. Linguistics and Philosophy 32(5). 429–474. https://doi.org/10.1007/s10988-010-9065-2.

Maier, Emar. 2016. Attitudes and mental files in DRT. Review of Philosophy and Psychology 7. 473–490.

Montague, Richard. 1973. The proper treatment of quantification in ordinary English. In J. Hintikka (ed.) Approaches to natural language. Dordrecht: Reidel. 221–242.

Partee, Barbara H. 1984a. Nominal and temporal anaphora. Linguistics and Philosophy 7. 243–286.

Partee, Barbara H. 1984b. Compositionality. In F. Landman and F. Veltman (eds.) Varieties of formal semantics. Dordrecht: Foris. 281–311.

Partee, Barbara H. 1996. The development of formal semantics in linguistic theory. In S. Lappin (ed.) The handbook of contemporary semantic theory. Oxford: Blackwell. 11–38.

Pustejovsky, James. 1995. The generative lexicon. Cambridge, MA & London: MIT Press.

Roberts, Craige. 1996. Anaphora in intensional contexts. In S. Lappin (ed.) The handbook of contemporary semantic theory. Oxford: Blackwell. 215–246.

Searle, John R. 1976. A classification of illocutionary acts. Language in Society 5(1). 1–23.

Searle, John R. and Daniel Vanderveken. 1985. Foundations of illocutionary logic. Cambridge: CUP.

Szeteli, Ádám, Attila Friedszám, Anna Szeteli, Laura Kárpáti, Judit Hagymási, Judit Kleiber and Gábor Alberti. 2023. Implementation of two-layered dynamic pragmatics. In K. Arai (ed.) Intelligent systems and applications: Proceedings of the 2022 Intelligent Systems Conference (IntelliSys), Vol. 3. Cham: Springer. 572–589.

Tulving, Endel. 2005. Episodic memory and autonoesis: Uniquely human? In H. S. Terrace and J. Metcalfe (eds.) The missing link in cognition: Origins of self-reflective consciousness. Oxford: Oxford University Press. 3–56.

Varga, László. 2016. The intonation of topic and comment in the Hungarian declarative sentence. Finno-Ugric Languages and Linguistics 5(2). 46–77.

Zadrozny, Wlodek. 1994. From compositional to systematic semantics. Linguistics and Philosophy 17. 329–342.

Zeevat, Hendrik. 1991. Aspects of discourse semantics and unification grammar. Doctoral dissertation. University of Amsterdam, Amsterdam.