A Dynamic Context Model for Questions

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- The framework, called Dynamic Categorial Grammar (DyCG), is expressed in type theory and captures all the central insights of the dynamic semantics tradition (Kamp, 1981; Heim, 1983).
- Despite the desirable characteristics of the framework, previous work on DyCG did not concern itself with the analysis of questions and answers in discourse.
- An adequate model of context, however, should include a way to keep track of questions that are uttered in discourse and capture the interpretation of their answers (among others, Ginzburg, 1994, 1995a,b; Roberts, 1996/2012, 2004; Zeevat, 2007; Farkas and Bruce, 2009).

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- The dynamic analysis incorporates the original characterization of questions and answers in Hamblin 1957 and Hamblin 1971.
- As a case study, I illustrate how the enriched context model captures the interpretations of constituent questions and their answers.

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- The semantic objects in the *n*-tuple are indexed by what are commonly called **discourse referents (DRs)**.
- DRs are modeled as natural numbers.

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- The TUD-stack is similar to the QUD-stack (Ginzburg, 1994; Roberts, 1996/2012) in the sense of keeping track of accepted questions in discourse.
- However, such questions are not stored as sets of propositions as in the QUD-stack but rather push onto the TUD-stack a DR for which further identification is sought (more on this later).

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4. there are no topics under discussion (which is indicated by $[\,]$).

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- The second component adds to the TUDs of the input context the TUDs coming from updating the context with the accepted utterance.

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- Applying this update to the context in (1) yields (4).

(4) $\lambda_{\mathbf{x}^2}.\langle(\text{donkey } x_0) \text{ and } (\text{bray } x_0) \text{ and } (\text{farmer } x_1) \text{ and } (\text{danced } x_1), [\,]\rangle$

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- s is the disjoint union of all types of semantic objects to which anaphoric reference is possible (left open).

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- This is the **dependent sum** of the c_n as n ranges over natural numbers.
- It denotes a disjoint union of a family of sets which is itself indexed by the members of another set (here, the natural numbers).

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  1. how Hamblin originally defined questions, and
  2. his notion of the **presumption** of a question.

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    3. Possible answers are mutually exclusive.
- Thus, such answers are **complete** in the sense that each possible alternative precludes all of the others.

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- Thus, a *who*-question is taken as asking for the maximal plurality with the property in question.

The meaning of *Who passed the exam?*

- The question *Who passed the exam?* has the meaning in (5).

(5) $\text{who passed-the-exam}_{\#} = \lambda_p.\text{exists}_X.\ p\ \text{equals}$
$(\text{maximize}\ X\ (\lambda_Y.(\text{person}_{\#}\ Y)\ \text{and}\ (\text{passed-the-exam}_{\#}\ Y)))$

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- $\text{person}_{\#}$ and $\text{passed-the-exam}_{\#}$ are distributive properties of pluralities; Z ranges over properties of pluralities.
- (maximize X Z) is the proposition that the plurality X is the maximal plurality with property Z.
- Thus, the question is asking for the maximal plurality that passed the exam.

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- Since possible answers are complete and mutually exclusive, the presumption of a question requires not only existence but the unique existence of a true complete answer.
- In other words, the Hamblin presumption of a question q is the proposition that exactly one of q's alternatives is true.
- With Hamblin (1971), I assume that the asker of a question (and in case of acceptance, all the interlocutors) are committed to the truth of the presumption of the question.

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- The dynamic Hamblin presumption expresses that *X* is the maximal satisfier of the property in question.

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  2. pushes the corresponding DR on top of the TUD-stack so that it becomes the current topic.
  3. This encodes the commitment of the discourse participants to (sufficiently) identify this DR.
  4. This is analogous to resolving a question in the QUD-stack-based approaches (e.g., Ginzburg, 1995a,b; Roberts, 1996/2012).

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- Applying this update to a context c yields the new context in (9).

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A dynamic analysis of answers

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- The descriptive content of a DR on the TUD-stack is recoverable from the CG (thanks to the Hamblin presumption).

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(10) A: Who passed the exam?

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- In (10), *John* is the focused expression and the post-focal part of the sentence is its continuation.

The meaning of long answers (cont'd)

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  3. $(\mathsf{max}\ Y\ (c\ \mathbf{x}))$ is used to pick up the DR from among the DRs that are on the TUD-stack.
- This is the way in which **la** encodes the anaphoricity of the answer to the accepted question.

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- In Martin 2013, the dynamic meaning of a proper name like *John* is analyzed as follows:

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- This DR is then passed to a specified dynamic property.

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- Intuitively, this is saying that x_j, which corresponds to the entity denoted by the focused expression *John*, is a non-null member of the maximal plurality that passed the exam.

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- The fact that the short answer is anaphoric to the topmost DR on the TUD-stack is captured by saying $x_n \sqsubseteq_{\text{nn}} \mathsf{top}\, (\pi_2(c\ \mathbf{x}))$.

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- Intuitively, this is saying that that x_j, which corresponds to the entity denoted by the focused expression *John*, is a non-null member of the topmost DR on the TUD-stack.

Discussion: TUD-stack vs QUD-stack

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- Thus, an advantage of the TUD-stack is that the DRs that are pushed onto it are already independently needed.

Discussion: TUD-stack vs QUD-stack (cont'd)

- Analyzing answers as anaphoric to the DRs on the TUD-stack automatically enables access to the continuation of the question word—thanks to the presumption of the question—which a short answer needs to have access to for its interpretation.

Discussion: TUD-stack vs QUD-stack (cont'd)

- Analyzing answers as anaphoric to the DRs on the TUD-stack automatically enables access to the continuation of the question word—thanks to the presumption of the question—which a short answer needs to have access to for its interpretation.
- This is another advantage of the TUD-stack over the QUD-stack since in the latter approach, the answer needs to 'look inside' the current QUD, which is stored as a set of propositions, and figure out the continuation.

Discussion: TUD-stack vs the ‘categorial’ approach

- The need to have access to the continuation of the question word is the reason why some scholars (e.g., Ginzburg, 1995a; Krifka, 2001, 2004; van Rooy, 1997; Ginzburg, to appear) adopt the so-called *categorial approach* (Hausser and Zaefferer, 1979).

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- Since questions receive functional interpretations, different questions are assigned different types.

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  2. At the same time, the fact that different questions can be conjoined as in (14c) is not accounted for.

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Future work (cont'd)

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d. Did John give **flowers to Mary**↑ or **cookies to Sue**?↓

etc.

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  2. what the addressee can provide given what she knows.
  3. Thus, what counts as a resolving answer is contextually parametrized.

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- Is this something that can be/needs to be captured in a formal theory of context?
- Or is it something that potentially involve extralinguistic parameters to fully account for?

Future work (cont'd)

(17) Context: A and B are in the barn.

A:Where's Burrita?

Future work (cont'd)

(17) Context: A and B are in the barn.

A:Where's Burrita?

B:...(Burrita walks into the barn.)

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References I

M. Aloni, D. Beaver, B. Clark, and R. van Rooij. The dynamics of topic and focus. In M. Aloni, A. Butler, and P. Dekker, editors, *Questions in Dynamic semantics*, CRiSPI. Elsevier, 2007.

C. L. Baker. *Indirect Questions in English*. PhD thesis, University of Illinois, 1968.

D. N. S. Bhat. The indefinite-interrogative puzzle. *Linguistic typology*, 4:365–400, 2000.

D. Farkas and K. B. Bruce. On reacting to assertions and polar questions. *Journal of Semantics*, 27:81–118, 2009.

J. Ginzburg. An update semantics for dialogue. In H. Bunt, R. Muskens, and G. Rentier, editors, *The Tilburg International Workshop on Computational Semantics*. ITK, Tilburg, 1994.

References II

J. Ginzburg. Resolving questions, I. *Linguistics and Philosophy*, 18 (5):459–527, 1995a.

J. Ginzburg. Resolving questions, II. *Linguistics and Philosophy*, 18 (6):567–609, 1995b.

J. Ginzburg. The semantics of dialogue. In M. Aloni and P. Dekker, editors, *Cambridge Handbook of Semantics*. Cambridge University Press, to appear.

C. L. Hamblin. *Language and the theory of information*. PhD dissertation, Logic and Scientific Method Programme, University of London, 1957.

C. L. Hamblin. Mathematical models of dialogue. *Theoria*, 2: 131–155, 1971.

M. Haspelmath. *Indefinite Pronouns*. Clarendon, Oxford, 1997.

References III

R. Hausser and D. Zaefferer. Questions and answers in a context-dependent Montague grammar. In F. Guenthner and S. Schmidt, editors, *Formal semantics and pragmatics for natural languages*, pages 339–358. Dordrecht: Reidel, 1979.

I. Heim. On the projection problem of presuppositions. In M. Barlow, D. Flickinger, and M. Wescoat, editors, *West Coast Conference on Formal Linguistics (WCCFL) 2*, number 114–225. Stanford: Stanford University, 1983.

H. Kamp. A theory of truth and semantic representation. In J. Groenendijk, T. Janssen, and M. Stokhof, editors, *Formal Methods in the Study of Language*, pages 1–42. Mathematical Center, Amsterdam, 1981.

References IV

M. Krifka. For a structured meaning account of questions and answers. In C. Fery and W. Sternefeld, editors, *Audiatur Vox Sapientia. A Festschrift for Arnim von Stechow*, pages 287–319. Akademie Verlag, 2001.

M. Krifka. The semantics of questions and the focusation of answers. In C. Lee, M. Gordon, and D. Büring, editors, *Topic and Focus: A Cross-Linguistic Perspective*, pages 139–151. Dordrecht: Kluwer Academic Publishers, 2004.

S. Martin. *The dynamics of sense and implicature*. PhD dissertation, Ohio State University, 2013.

S. Martin. A unidimensional syntax-semantics interface for supplements. In *Proceedings for ESSLLI 2015 Workshop 'Empirical Advances in Categorial Grammar' (CG 2015)*, pages 82–106, 2015.

References V

S. Martin and C. Pollard. A dynamic categorial grammar. In G. Morrill, R. Muskens, R. Osswald, and F. Richter, editors, *Formal Grammar 2014, LNCS 8612*, pages 138–154. Springer-Verlag Berlin, 2014.

C. Roberts. Information structure: towards an integrated formal theory of pragmatics. In J. H. Yoon and A. Kathol, editors, *Ohio State University Working Papers in Linguistics (OSUWPL)*, volume 49, pages 91–136. Ohio State University, Department of Linguistics. Reprinted with a new Afterword in *Semantics and Pragmatics* volume 5, 2012, 1996/2012.

C. Roberts. Context in dynamic interpretation. In L. Horn and G. Ward, editors, *Handbook of Contemporary Pragmatic Theory*, pages 197–220. Blackwell, 2004.

References VI

R. van Rooy. The context-dependence of questions and answers. In P. Dekker, M. Stokhof, and Y. Venema, editors, *Proceedings of the Eleventh Amsterdam Colloquium*. ILLC, University of Amsterdam, Amsterdam, 1997.

H. Zeevat. Exhaustivity, questions and plurals in update semantics. In M. Aloni, A. Butler, and P. Dekker, editors, *Questions in Dynamic semantics*, CRiSPI. Elsevier, 2007.