(In)Coherence of discourse 3

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(In)Coherence of discourse 3

Loria – room C005

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Program

Thursday 3rd December 2015

09:30 Registration and opening
09:40 *Julie Hunter* - Discourse Structure in Embodied Conversation
10:40 break
11:00 *Alda Mari and Christian Retoré* - "Chaque vin a sa lie." versus "Toute nuit a un jour." Does the difference in the human processing of "chaque" and "tout" match the difference between the proof rules for conjunction and quantification?

14:00 *Massimo Poesio* - Measuring the level of animacy, concreteness and abstractness in a text: applications in a clinical context
15:00 *Uwe Reyle and Arndt Riester* - QUD-construction via Underspecified DRSs
16:00 Break
16:20 *Arpit Sharma, Davy Weissenbacher, Chitta Baral and Graciela Gonzalez* - Generating Semantic Graphs from Image Descriptions for Alzheimer's Disease Detection
17:20 end of the first day

Friday 4th December 2015

09:00 *Daniel Altshuler and Dag Haug* - Formalizing temporal anaphora with PCDRT: A look at 'Sylvie'
10:00 break
10:20 *Ellen Breitholtz, Christine Howes and Mary Lavelle* - Enthymematic reasoning in a moral dilemma - do patients with schizophrenia reason differently?
11:20 *Fabrice Louis* - (In)cohérences du discours: une approche anthropologique fondée sur la perspective brandomienne du concept

Julie Hunter
post-doctoral researcher at IRIT (Université Toulouse III - Paul Sabatier)

Title: Discourse Structure in Embodied Conversation

Abstract

In embodied conversation, non-linguistic events can make important contributions to the semantic content of the discourse. This talk explores a rich array of semantic dependencies between non-linguistic events and linguistically specified contents and shows that these dependencies are a critical part of the content of the interaction. Inferring these dependencies, inferring the rhetorical role of non-linguistic events, and conceptualizing non-linguistic events—i.e., associating them with a suitable description—are logically co-dependent tasks. Extending Segmented Discourse Representation Theory, I present an analysis of semantic dependencies between linguistic and non-linguistic units in embodied discourse, and explore how these dependencies affect discourse structure and constraints on developing such structure, such as the Right Frontier Constraint. Empirical evidence for the analysis is supported by a detailed corpus study, which I introduce in the talk.

Massimo Poesio
University of Essex, School for Computer Science and Electronic Engineering

Title: Measuring the level of animacy, concreteness and abstractness in a text: applications in a clinical context

(based on work by Kevin Glover and Massimo Poesio)

Abstract

Animacy plays an important role both in linguistic and psychological work on salience (Pearson, Stevenson and Poesio, 2001; Zaenen et al 2004) and in computational treatments of anaphora resolution (e.g., Orasan and Evans, 2001; Bergsma, 2005) but in such work a very simplified, binary notion of animacy is typically used. However, more detailed analyses of animacy have been proposed, in which animacy is integrated with other semantic distinctions into an animacy hierarchy (e.g., Foley and van Valin, 1985; Dahl and Fraurud, 1996; Yamamoto, 1999; Denison, Scott and Börjars, 2008).

In this work, we first of all argue that the type of animacy 'hierarchy' best supported by the evidence is a tripartite distinction between animated, concrete, and abstract. Second, we discuss (supervised) computational models to assign to words and text their degree of animacy, concreteness and abstractness which crucially rely on a feature of nouns we call the GENITIVE RATIO - the ratio between the number of uses of a noun with -s genitive and the number of uses with the -of genitive. Third, we apply these models in two different settings: to revisit previous claims about the connection between animacy and salience, and to explore claims about the effect that Alzheimer and depression have on the abstractness or concreteness of a text. We will focus on the clinical context in this talk.

In work such as (Ahmed et al, 2013), statistical measures of linguistic performance automatically extracted from text have been used to measure the progression of Alzheimer. In this work, we explored the use of our concreteness rating as a metric for such a progression, on the basis of evidence that in patients with Alzheimer's disease the vocabulary becomes progressively more concrete (see, e.g., (Chertkow et al, 2008)).

By contrast, substantial psychological evidence suggests an association between depression and 'reduced concreteness thinking' (Watkins et al, 2008). In a second application of our concreteness rating, we applied our models to measure the difference in concreteness between texts produced by authors such as Virginia Woolf in a relatively untroubled period of their lives and in later periods associated with increasing depression.

Formalizing temporal anaphora with PCDRT: A look at 'Sylvie'

Daniel Altshuler and Dag Haug

Intro: This talk considers temporal ambiguity in the French novella, *Sylvie*, whose resolution is especially challenging to model because, at a particular point of the novella, the reader typically chooses a resolution strategy that she later finds to be *wrong*. We show how Haug's (2013) PCDRT allows us to model *how* the particular interpretation changes when it is extended with more content. Two key insights aide the analysis: (i) the set of *drefs* is ordered, with the compositional semantics ensuring that the *drefs* are introduced in the 'proper order' and (ii) anaphoric expressions also introduce *drefs*, albeit ones that have to contract a referential relationship with another *dref* in the context. In this way, we avoid assuming that the syntax delivers a pre-indexed logical form to the semantics—a move which undermines anaphora resolution as being "an essential part of natural language meaning and inference" (Beaver 1999; see also Bittner 2007 and Muskens 2011).

Methodology: The goal is to provide an analysis of a crucial ambiguity in *Sylvie* that arises during the transition from Chapters 3-4, and maintained up until Chapter 7, where the ambiguity is resolved. While this ambiguity results from several sources, we follow Hobbs 1990 in proposing that what plays the crucial role is the structuring of the text according to discourse coherence principles. To show, and ultimately derive their role, we are, unfortunately, forced to analyze a simplified version of the text, in English.[1]

Data: Crucial to the interpretation of our simplified discourse in (1) is inferring discourse relations between each sentence. Aided by the preposed *while*-clause, we infer *Elaboration* in (1a)-(1b). As for (1c), the pluperfect describes a state, which enters into a *Background* relation. But with what? There are two possibilities: either (1c) provides a background to (1b), or it functions as a scene-setter for (1d), in which case the reference is resolved cataphorically. Crucially, observe that (1d) is, in itself, ambiguous. While it is clear that (1d) serves an argument of *Narration*, it's unclear what the other argument is. One possibility is that (1d) carries the story forward from (1a), viz. the repeated mention of Loisy: the narrator is on his way to Loisy and now he has arrived. In this case, the events narrated in (1d)-(1e) take place after the journey to Loisy reported in (1a). This would be compatible with both the aforementioned anaphoric and the cataphoric resolution of (1c), giving us the two structures in (2) and (3). As it turns out, however, both are wrong! This especially clear in (1f), where it transpires that the carriage is about to pass by Orry, which is on the way to Loisy. This means that the events narrated in (1c)-(1e) must precede the journey. In other words, (1c)-(1e) form a complex discourse unit, which is in the scope of the memory report in (1b); see (4), which represents the *correct* structure.

(1) a. (Chapt. 3). . .*I'm on a carriage going to Loisy*.
b. *While the carriage is climbing, I will put in order my memories of the times when I was there* (End of Chapt. 3)
c. (Beginning of Chapter 4) *It had been a while since I met Adrienne.*
d. *I found myself once again at the annual festival in Loisy . . .*
e. . . .*We pretended to be married that morning.* (End of Chapt. 6)
f. (Beginning of Chapt. 7) *The carriage will pass by Orry.*

(2) *Elaboration*(π_a, π_b); *Background*(π_c, π_d); *Narration*(π_a, π_d); *Narration*(π_d, π_e)

(3) *Elaboration*(π_a, π_b); *Background*(π_b, π_c); *Narration*(π_a, π_d); *Narration*(π_d, π_e)

(4) *Elaboration*(π_a, π_b); *Background*(π_c, π_d); *Narration*(π_d, π_e); *Attribution*(π_b, π_s)[2]; *Narration*(π_a, π_f)

Representing (1): We represent (1a)-(1f) as DRSs in (5a)-(5f) respectively. (5a) introduces a state s_1 of being on a carriage that will be in state s_2, namely being in Loisy. (5b) introduces an event e_1 of inviting to remember a state s_3, namely being in Loisy. Moreover, we assume that s_3 precedes e_1 given the semantics of *remember* and, given the semantics of the perfective, e_1 is both instantiated at some prominent state S_4 (resolved anaphorically) (Webber 1988) and the post state of e_1 (i.e. the invitation is open, s_5) is introduced into the discourse context (Bittner 2008). (5c) introduces an event e_2 of meeting Adrienne. Given the semantics of the perfect, the post state of this event is also introduced, s_6, which holds throughout some prominent event E_3 (resolved cataphorically). (5d)-(5f) introduce events of finding e_4, pretending e_6 and passing by e_7 respectively. As in (5b), these events are instantiated at prominent states S_7, S_9, S_{11} respectively (resolved anaphorically) and their post-states s_8, , s_{12} are introduced into the discourse context.

Following Hobbs 1979 and Kehler et al 2008 we assume that resolving the interpretation of an anaphoric expression and establishing discourse relations are correlated and mutually constraining. Given this assumption, we show how resolving S_4 E_3 S_7 in light of (2) and (3) lead to inconsistent interpretations once

[1] In the talk we will show the original French text and briefly discuss how we translated and simplified.

[2] Where the complex discourse unit π_s consists of π_c, π_d, π_e

we proceed to resolve S_9 and S_{11}. Then, we show a consistent interpretation is possible with (4).

(5) **a.** [s_1 s_2 | be.on.carriage.going.to.be.in(s_1, s_2), be.in.Loisy(s_2)] ;
b. [e_1 s_3 S_4 s_5 | invitation.to.remember(e_1, s_3), be.in.Loisy(s_3), $\tau(s_3) < \tau(e_1)$, $\tau(e_1) \subseteq \tau(S_4)$, post($e_1$) = s_5] ;
c. [e_2 s_6 E_3 | met.adrienne(e_2), post(e_2) = s_6, $\tau(e_3) \subseteq \tau(s_6)$] ;
d. [e_4 S_7 s_8 | found.myself(e_4), $\tau(e_4) \subseteq \tau(S_7)$, post($e_4$) = s_8] ;
e. [e_5 S_9 s_{10} | pretended.to.be.married(e_5), $\tau(e_5) \subseteq \tau(S_9)$, post($e_5$) = s_{10}] ;
f. [e_6 S_{11} s_{12} | carriage.will.pass.by.Orry(e_6), $\tau(e_6) \subseteq \tau(S_{11})$, post($e_6$) = s_{12}]

Formalizing anaphora: PCDRT (Haug 2013) is a development of CDRT (Muskens 1996) that keeps the compositionality of the latter approach, while developing a more sophisticated account of anaphora that does away with syntactic coindexation and allows a clean separation of monotonic and non-monotonic content. To achieve this, PCDRT makes use of *ordered dref*s, i.e. the indices on s_1 s_2 are significant and reflect the order in which the *dref*s are introduced in the discourse. Further, even anaphoric expressions introduce *dref*s (so we can think of PCDRT *dref*s as corresponding to *dref occurrences* in other frameworks). These *dref*s are rendered as capitalized variables S_4, E_3 etc. in (5), where capitalization abbreviates the semantic requirement that there be a coreferent antecedent, $A(x) = x$, where A is the anaphoric resolution which is supplied by non-monotonic reasoning over the semantic contents of the discourse. For details, see §5.4 of Haug 2013, whose *ant* predicate partly corresponds to our capitalization, but also includes the requirement that the antecedent precedes the anaphor, i.e. $A(x) < x$.[3] To deal with cataphora, however, we make this constraint non-monotonic. We can now see how the interpretation of (1) proceeds. For simplicity we assume that anaphoric resolution is categorical at each stage of the discourse, although it would be possible and more realistic to use a probabilistic resolution. On the monotonic side, the interpretation is simply successive conjunction (symbolized with ';') of (5a)-(5f). Interpretation (3) of (1a)-(1e) then gives us the interpretation in (6) (a pair of monotonic and non-monotonic content):

(6) <(5a) ; (5b) ; (5c) ; (5d) ; (5e), A= {$S_4 \rightarrow s_1$, $E_3 \rightarrow e_4$, $S_7 \rightarrow s_2$, $S_9 \rightarrow s_8$}>

Given the resolution $S_7 \rightarrow s_2$ we can conclude $\tau(e_4) \subseteq \tau(s_2)$ from (5d) and hence $\tau(s_1) < \tau(e_4)$ by the semantics of the predicate in (5a). From (5e) with the resolution of S_9 to s_8 we get $\tau(e_5) \subseteq$ post(e_4) and hence $\tau(e_4) < \tau(e_5)$. If we now attach (5f) to (5e) via *Narration*, and therefore resolve S_{11} to s_{10}, we get $\tau(e_5) < \tau(e_6)$ by similar reasoning and hence the timeline $\tau(s_1) < \tau(e_4) < \tau(e_5) < \tau(e_6)$; but this is impossible given world knowledge that Orry is on the way to Loisy, which entails $\tau(e_6) \subseteq \tau(s_1)$. To resolve the contradiction, the interpreter must non-monotonically update the resolution so that $S_7 \rightarrow s_3$ and $S_{11} \rightarrow s_5$, making (5c)-(5e) an extended flashback, while (5f) continues the narration from (5b) and provides further information on the travel described in (5a).

Summary: Our analysis extends PCDRT to the temporal domain so that we can offer a model-theoretic semantics for each stage of the discourse (including stages with unresolved cataphora) and show how it interacts with a non-monotonic anaphoric resolution strategy in the incremental interpretation of discourse. It does away with preliminary DRSs and can be seen as a way to provide a semantics for partially underspecified SDRT-style discourse trees, obviating the need for full specification before interpretation.

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[3] Like CDRT, PCDRT uses an abbreviation language which 'hides' the distinction between drefs and their real-world referents. Note that while the equality in $A(x) = x$ is a relation between individuals (type e), precedence in $A(x) < x$ is a relation between drefs (type π). See Haug 2013 for full representations in the underlying logic.

Enthymematic reasoning in a moral dilemma – do patients with schizophrenia reason differently?

Ellen Breitholtz, Christine Howes, Mary Lavelle

September 15, 2015

1 Introduction

It is well known that world knowledge plays an important part in our understanding of pragmatic phenomena that are crucial for our ability to interact successfully with other human beings. A perspective on how world knowledge becomes relevant and even necessary in conversation and other types of discourse is the *micro-rhetorical* perspective presented and formally modelled using Type Theory with Racords (TTR) in Breitholtz (2014). According to this approach, discourse is to a great extent made up of common sense-, or *enthymematic*, arguments. These arguments are underpinned by *topoi*, principles according to which it is acceptable to reason in a particular social group or a particular context. When we interact we expect topoi to be common ground, or we are explicit enough in the argumentative structure of our dialogue contributions to make sure that our dialogue partner accommodates the relevant topoi. In (1) for example, speaker A believes that the topos "if a route is shorter, it is preferable" or similar is in common ground, and this is why (1b) is a good reason to motivate choosing Walnut Street over other available routes.

(1) a. A: Let's walk along Walnut Street.

b. A: It's shorter.

One important property of topoi as opposed to, for example, the rules of a non-monotonic logic, is that one individual may entertain several topoi leading to different conclusions in any given context. This is also an important feature of human reasoning – we may fully and correctly interpret the arguments of our interlocutors and make them part of common ground even if we do not agree with them.

Many different aspects of communicative difficulties in patients with schizophrenia have been hypothesised. For example, patients with schizophrenia may have difficulty monitoring their own verbal behaviour (Johns et al., 2001) and also display difficulty understanding and interpreting figurative language or metaphor and inferring other's mental states (Gavilán and García-Albea, 2011). Studies have also found that patients display differences in the way they reason in a number of decision making and logical reasoning tasks. However, perhaps surprisingly, these show no evidence of a general reasoning difference but only of subtle specific differences, for example, a tendency to jump to conclusions in the patient groups (see Dudley and Over, 2003, for a review). We hypothesise that this tendency is related to a difference in the sets of topoi that are available to patients and non-patients.

However, most of this work relies on testing individuals and fails to take interaction into account. Recent work (Lavelle et al., 2012) shows that in interactions involving patients with schizophrenia, while patients non-verbal communicative behaviour is different to that of healthy participants, their interlocutors also adapt their non-verbal behaviours, despite being unaware they were interacting with a patient. In this paper we will investigate whether this is also true for linguistic behaviour, by investigating the reasoning involved in dialogues which include a patient diagnosed with schizophrenia and dialogues between healthy controls. We are interested in the way particular topoi are drawn on, and which assumptions underpin the enthymematic arguments made.

2 Method

Data The data used for this exploratory study are a subset of the transcriptions of video recorded face-to-face dialogues from 19 patient (1 patient, 2 healthy participants) and 18 control (3 healthy participants) interactions reported in Lavelle et al. (2012).

Task Participants discussed the *balloon task* – an ethical dilemma requiring agreement on which of four passengers should be thrown out of a hot air balloon that will crash, killing all the passengers, if one is not sacrificed. The choice is between a scientist, who believes he is on the brink of discovering a cure for cancer; a teacher who is 7 months pregnant; her husband, the pilot; and a nine-year old child prodigy who is considered

to be a twenty-first century Mozart. This task has been used for studying many aspects of dialogue, and is known to stimulate discussion (Howes et al., 2011).

Annotations Following Breitholtz and Howes (2015), 5 control dialogues and 5 patient dialogues were annotated for turns containing arguments regarding who to save and who to throw out of the balloon.

3 Results and discussion

As can be seen from Table 1, patients come up with fewer arguments regarding who to throw out of the balloon (mean 3.2 per person, compared with 8.0 per person in the control groups; $t_{18} = 2.84, p = 0.01$). However, patients also make fewer dialogue contributions (188.4 vs 430.7 words $t_{13} = 2.11, p = 0.05$). Numerically, control participants in dialogues with a patient come up with fewer arguments than those in dialogues without a patient, suggesting that controls interacting with patients also moderate their reasoning behaviour, in line with the non-verbal findings from Lavelle et al. (2012) though this is not statistically significant given the small sample size. Further research is needed to validate this result.

	Control	Patient groups			Total
	groups	Controls	Patients	Total	
Conversations	5			5	10
Participants	15	10	5	15	30
Turns per person	42.8	40.3	27.8	36.1	39.5
Words per person	408.2	430.7	188.4	349.9	379.1
Arguments per person	8.0	6.7	3.2	5.5	6.8
Arguments per turn	0.187	0.166	0.115	0.153	0.171

Table 1: Overview of annotated data

Qualitative analysis of the data indicates that patients' reasoning is less likely to change over the course of a conversation, as shown in (2), despite 200 intervening turns and a number of different arguments put forward by the patient's interlocutors.

(2) 4: but I'm gonna say that I would go for <unclear> Sue 'cause like she's got her baby so is extra weight

209: I'd still go with Sue though you know what I mean she's carrying extra weight like

This exploratory study shows that the way in which patients with schizophrenia access and use enthymematic arguments in dialogue may be different from the ways in which healthy participants do, and suggests many promising avenues of future research. Specifically, by taking the taxonomy of balloon task arguments from Breitholtz and Howes (2015) we will investigate whether patients use different underlying topoi to their interlocutors, or are less able to entertain conflicting topoi, and also how their interlocutors adapt their own chains of reasoning due to the presence of a patient in the dialogue. A game board semantics including enthymemes and topoi modeled in TTR, as presented in Breitholtz (2014), gives us a way to formally model these differences.

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(In)cohérences du discours: une approche anthropologique fondée sur la perspective brandomienne du concept.

Fabrice Louis

Je souhaite étayer l'idée selon laquelle le problème des (in)cohérences du discours est un problème lié à celui de l'accord dans le langage. Cela signifie que le problème est lié à celui d'une action conjointe de deux agents qui sont bien conscients de devoir résoudre un problème : « s'entendre » un minimum pour ne pas faire deux monologues au lieu d'un dialogue. Cette compétence à s'organiser de manière conjointe ne peut exister que si chaque interlocuteur est capable d'adopter une perspective extérieure, celle de son partenaire, pour maintenir son propre rôle dans la coopération.

Je souscris donc à l'hypothèse selon laquelle « c'est un déficit interactionnel, plutôt qu'un dysfonctionnement rationnel, qui est ici en jeu »[1] dans le cadre d'une conversation qui relève de l'inconsistance pathologique d'un interlocuteur.

Deux points sont à éclaircir: ce que nous entendons par langage et ce que nous entendons par accord. Mais il semble aussi que nous devrions tenter de découvrir ce qui produit cet accord ou cette incohérence. Dans cette perspective, trois termes interviennent dans une relation qui est causale. Pour le dire de manière métaphorique, le langage paraît entraîné par un mécanisme pour produire un accord entre les hommes. L'incohérence du discours laisse alors présager l'existence d'un mécanisme déficient. Dans une perspective wittgensteinienne, l'idée que nous défendons est au contraire celle-ci: le langage est identifiable avec la variété d'activités par lesquelles les hommes s'accordent. Il n'y a donc pas trois termes à cerner mais un seul. On pourrait préférer faire correspondre au langage un type d'accord bien particulier. Admettre ceci reviendrait pourtant à masquer l'essentiel : nous commençons notre vie par un tout petit nombre d'interactions qui sont les racines de nos interactions langagières. Qu'apprenons-nous ensuite pour que ces racines viennent nourrir notre aptitude au langage? Pour certains enfants autistes, on connait l'importance des thérapies comportementales fondées sur le renforcement des scènes d'attention conjointe, ces interactions nécessaires pour qu'existe « la référence linguistique, acte social par lequel une personne s'efforce d'en amener une autre à porter son attention sur une chose présente dans le monde environnant »[2].

C'est dans une telle perspective que ma communication s'inscrira. Je tente d'identifier les déficits d'apprentissages chez certains sujets manifestant des incohérences de discours en restreignant mon étude au cas où les incohérences apparaissent dans le cadre des assertions. Je m'appuie sur deux résultats de travaux qui constituent le socle de mon argumentation:

- *la perspective anthropologique wittgensteinienne*. Le locuteur est sans aucun doute l'auteur de ses assertions mais il n'est pas l'auteur du sens de ce qu'il dit. Pour comprendre le sens de ce dit le locuteur, il est nécessaire de comprendre la manière dont les hommes s'accordent par leurs actions lorsqu'elles sont en lien avec ce que dit le locuteur. Soutenir ceci, c'est soutenir que c'est à l'intérieur de jeux de langage que les énoncés ont du sens. Ces jeux de langage existent grâce aux faits du langage, ces faits qui donnent du sens à nos actes de langage. Or Wittgenstein soutient que « le langage se réfère à un mode de vie » (2009, p.273)[3]. Il s'agit donc de décrire correctement les actions qui constituent ce mode de vie pour comprendre comment est organisé le langage.

[1] Maxime Amblard, Musiol Michel, Rebuschi Manuel. *Une analyse basée sur la S-DRT pour la modélisation de dialogues pathologiques*. Mathieu Lafourcade and Violaine Prince. Actes de la 18e conférence sur le Traitement Automatique des Langues Naturelles - TALN 2011, Jun 2011, Montpellier, France. Laboratoire d'Informatique de Robotique et de Microélectronique, pp.6, 2011. <hal-00601622>

[2] M.Tomasello , *Aux origines de la cognition humaine*, Paris : Retz, 2004, p.94

[3] Wittgenstein, *Remarques sur les fondements des mathématiques*, Paris : Gallimard, 2009

La conception wittgensteinienne a pour mérite de mettre en évidence l'existence d'un arrière-plan d'actions sans lequel nos actes de langage sont vides de sens. Derrière les désaccords langagiers, cette conception nous incite à chercher des différences de formes de vie. Nous souhaitons pousser un peu plus loin cette idée en admettant qu'il en va ainsi également pour certaines formes d'incohérences. Mais cette conception wittgensteinienne est holiste et elle doit être précisée. La conception inférentialiste de R. Brandom réduit en partie le holisme de la conception wittgensteinienne des jeux de langage. Elle nous permet en effet d'introduire l'idée d'une colonne vertébrale structurant, dès le plus jeune âge, l'apprentissage des jeux de langage. Cette colonne vertébrale structurante est celle-ci : un sujet qui asserte réellement quelque chose est un sujet qui s'engage sur un certain nombre de points, pratiquement ou théoriquement, vis à vis de quelqu'un.

- *Une conception pragmatiste des concepts*. Le postulat de Brandom[4] selon lequel «souscrire et s'engager sont au centre de l'agir rationnel »[1] est fécond car il implique que «les concepts sont des normes qui déterminent simplement ce dont nous nous sommes rendus responsables, ce envers quoi nous sommes engagés....»[5] Ainsi le terme de «concept» fait référence à tout un ensemble d'actions simples que nous pouvons assumer de manière normative.

Deux corollaires nous permettent d'imaginer comment réduire certains troubles de la conceptualisation et par suite certaines formes d'incohérences:

1. le contenu conceptuel d'une assertion est défini par les engagements de celui qui fait l'assertion. Ainsi la valeur conceptuelle d'une assertion augmente avec le nombre ***n*** (le score) des engagements dont est responsable celui qui asserte.

Par exemple, dans le cas où le locuteur dit ce qui lui passe par la tête, il ne s'engage sur rien. Ainsi le score des engagements est nul et ce que dit le locuteur ne peut être pris pour une assertion. L'incohérence du discours peut alors être le résultat d'une incapacité à maintenir son propos sur un mode identique : on peut difficilement trouver un discours cohérent à partir du moment où le locuteur enchaîne des propos qui laisse opaque ses engagements.

2. «Comprendre le contenu conceptuel envers lequel on s'est engagé est une sorte de maîtrise pratique: un savoir-comment qui consiste à être capable de discriminer ce qui découle ou pas de l'affirmation, ce qui en serait une confirmation empirique,.. ».[6]

Rendre explicite ce savoir-comment, c'est le mettre sous forme d'une affirmation que les choses sont ceci et non cela. Comment faciliter le jugement que les choses sont bien ceci et non cela ? En produisant des états du monde par une action sur laquelle tout le monde peut s'accorder pour valider une affirmation.

Renforcer la cohérence du discours par des jeux où le locuteur apprend à s'engager

Il est possible d'améliorer les capacités de conceptualisation par le développement de la capacité à asserter grâce à des jeux de langage élaborés en EPS, par exemple dans le cadre de l'apprentissage du rôle de conseiller en badminton.

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[4] R.Brandom, *L'articulation des Raisons*, Les éditions du Cerf, Collection Passages, Paris, 2009, p.38
[5] R.Brandom, *Ibid*, p.41
[6] R.Brandom, *Ibid*, p.27

Incoherences of discourse : an anthropologic approach based upon Brandomian perspective of language

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I would like to support the idea that the problem of incoherences of discourse is a problem related to the one of joint action of two agents that have to agree not to have two monologues instead of a dialogue. This ability to get organized in a joint way can only exist if each interlocutor is able to adopt an external point of view, that is to say his or her partner's, to uphold his or her own role in the cooperation.

My approach takes its place in the tradition of analytical philosophy. I join this tradition mainly by going further into what is usually called "the grammatical turn" taken by philosophy thanks to Wittgenstein. This point of view consists in operating conceptual distinctions that enable to raise what Ryle named category errors in the mental study. These last ten years, I tried to prove that such an approach is fertile to improve our understanding of problems related to the learning of physical activities. In what follows, I extend this approach to the very specific cases of language acts that produce discourses that are clinically described as incoherent.

In order to carry through such an analysis, I think it necessary to distinguish the adjectives "voluntary" and "intentional" that qualify our actions. A clear analysis of these two concepts allows not to switch too quickly from one study that enables to understand the discourse incoherence to another one that considers the causes_ physiological particularly_ of this incoherence. This is a necessary condition for the analysis of the discourse incoherence to be done within the framework of a philosophical approach of mental state. I will begin my analysis with this distinction.

The relevance of a philosophical approach of mental? To specify the way the anthropological paradigm of mental by Wittgenstein can help us understand some cases of incoherent discourse among schizophrenic persons. These cases are mainly those where the meaning of the discourse isn't understood any more, neither by the locutor nor the interlocutor. And it is a matter of describing this reality as mental, since this problem is related to mental health. I support that the externalist conception of the wittgensteinians is more adequate than the internalists onthis particular point.

This is the reason why the pragmatist, expressivist and rationalist conception of language by Brandom is at the very heart of my argumentation. It is a way of clarifying the Wittgenstein notion of language games, giving it a spine : the inferentialist framework.

The use of this approach to the incoherence of discourse?

1. Specifying the hypothesis according to which it's a interactional lack in the incoherent discourse of some schizophrenic persons : this deficiency is an inability concerning certain types of commitment.

2. Describing what kind of language game learning processes allow us to improve our ability to commit in an inferential way.

What lead of research is described by the following communication?

We begin our lives with a very small number of interactions that are the roots of our language interactions. What do we learn later in order that these roots feed our language ability? In the case of some autistic children, we know of the importance of behavioural therapies, based upon the reinforcement of joint attention scenes. these necessary interactions for the existence of the linguistic reference. As far as I am concerned, I try to identify what is related to lacks of learning among some schizophrenic persons that show incoherences of discourse.

But in order to define what one could name "a mental curriculum", one needs to have a conception of mind and language that escape cartesian dualism and materialism.

"Chaque vin a sa lie." versus *"Toute nuit a un jour."*

DOES THE DIFFERENCE IN THE HUMAN PROCESSING OF "*chaque*" AND "*tout*" MATCH THE DIFFERENCE BETWEEN THE PROOF RULES FOR CONJUNCTION AND QUANTIFICATION?

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Abstract

This paper claims that the difference between the way French native speakers use the two universal quantifiers "tout" and "chaque" corresponds rather well to the proof theoretical difference between 1) proving $P(a_i)$ for each element a_i in the domain and conjoining them and 2) proving $P(x)$ for a generic element x. Experiments have been designed (but not yet realized) in order to support this claim.

Semantic and discursive properties of *tout* and *chaque* In spite of the abundant literature on quantification in French, little if not any attention has been paid to the types of discourses in which quantifiers are used. Likewise, relatively few studies have investigated the differences between *tout* and *chaque*, which are both universal quantifiers, ranging over singular entities.

Our starting observation with [12], is that *tout* is naturally used in generic sentences (see also [11]), whereas *chaque* is blocked. Not to create confusion, we do not provide English translations for *tout* and *chaque* and use the metalinguistic TOUT/CHAQUE.

(1) a. Tout lion a une crinière *(*TOUT *lion has a mane.)*
b. * Chaque lion a une crinière. (no generic reading) *(*CHAQUE *lion has a mane.)*

(2) a. Tout homme est mortel. *(*TOUT *man is mortal.)*
b. *Each man is mortal. (no generic reading) *(*CHAQUE *man is mortal.)*

The general tout*, comparison with* n'importe quoi *Tout* has been argued to be a Free Choice Item (FCI) (see [12]) and to have an intrinsic modal semantics (although there exist a variety of proposal, their common core is that FCI are modals). A comparison between *n'importe quoi* and *tout* that enriches the already noted differences, can help us spelling out in greater details the semantics of *tout*. Firstly, FCI are not as natural as *tout* in generic sentences, or, at least, they do not lead to the same interpretation.

(3) # N'importe quel homme est mortel. *(Any man is mortal.)*

Clearly *tout* can sustain a case in which an infinite set is used. *N'importe quoi* does not. To interpret (3), we would need to fix a set of relevant men, and pick any one of those. This leads us to conclude that *tout* is the absolute general universal quantifier in language.

Another piece of data leading to this conclusion is the contrast between *tout* and *n'importe quoi/qui* with respect to sub-trigging. Sub-trigging, is the term coined by [14] to describe the fact that episodic sentences can be rescued when the NP head noun is modified by an adjective or a post-nominal modifier. For English *any* [5] proposes that the sub-trigger introduces a spatio-temporal restriction that prevents the any-quantifier to range over the totality of possible worlds or situations.

(4) a. * Mary read any book.
b. Mary read any book that she bought.

We observe an opposite behavior with respect to sub-trigging. With imperatives, FCI do not require sub-trigging, *tout* does (note that *tout*, despite [12] can be used in imperatives, granted that sub-trigging is used).

(5) a. Prend n'importe quelle carte ! *(Take FCI card!)*
b. Prend *toute carte/toute carte qui puisse te faire gagner ! *(Take* *TOUT *card /* TOUT *card that allows you to win!)*

Why do we have to accommodate here a restriction ? Because the context (a card game) presupposes the existence of a limited set of cards, and this restriction clashes with the default information of absolute generality of *tout*. A restriction for the domain of quantification of *tout* is thus needed for the sentence to be felicitous.

As we mentioned, current analyses of FCI and *tout* in particular, rely on a modal semantics. It is tempting to extend this line of analysis and to use a modal semantics also for capturing the absolute generality of *tout* (even if our description in fact departs in some ways from [11]).

While modal analyses are enlightening in many respects, they raise the question of how we can construct or compute the set of all possible worlds. Restricting via ordering sources the set of relevant worlds in a natural way out of the problem. However, here we explore an alternative route asking when can one assert a given sentence and how can one refute an asserted sentence. Studying the condition of asserting and refuting a statement is a different but worth studying semantics. This will be our choice. However, we want to first consider the types of sentences in which *tout* and *chaque* are used, further justifying the use of a semantics that can capture the conditions for assertion and refutation, rather than a purely truth conditional approach.

Chaque vs. tout: an analytical and a synthetic quantifier The starting point of our description of the types of statements in which *tout* and *chaque* are used, will consist in acknowledging that *tout* and *chaque* are employed, respectively, in prescriptive and descriptive statements. We substantiate this labels by spelling out the ingredients of prescriptivity and descriptivity.

Prescriptive statements are grounded in rules of the form $P(x) \to Q(x)$ [11]. The rule must pre-exist, and it is meant to reveal a non-accidental association between the P property and the Q property. We will observe that the statements in which *tout* is used are analytical generic ones, akin to indefinite generic statements. [3, 15, 4, 13, 16]

We will argue that observation of each of the entities is not needed, as the ability of the domain of quantification of being infinite reveals. *Tout*-statements, being universals, hardly tolerate exceptions but they nevertheless do: if one of the entities is not conformed to the rule, one might even discuss whether it really belongs to the class one quantify over.

Chaque is used in descriptive statements. It requires the domain of quantification to be finite; moreover, the content in the scope of the quantifier can be accidental to the entities in the restriction (unlike what happens with *tout*, for which only intrinsic properties of the class are targeted). The notional category 'universal quantification', with *chaque*, we show, takes the form of a closure over a domain, each of the entities of which has been inspected. Typically, *chaque*, cannot be used as a generic [12].

We refer to *tout*-universal quantifier as *analytical universal quantifiers* and to *chaque*-type of quantifier as *synthetic universal quantifier* in order to disentangle the type of the statements in which they are used.

The two proof-theoretical views of universal quantification The model theoretic view of universal quantification is completely naive: $\forall x P(x)$ is true whenever $P(x)$ holds for all x in the domain. Most authors consider $\forall x P(x)$ is nothing than a short hand for $\&_{x\in D} P(x)$ which is not necessarily a first order formula e.g. when D is infinite (or worse, uncountable, like instants or places). This conjunctive view presupposes that the domain is clear, and this is rather rare in natural language.

In order to model meaning, we think that sense (Sinn) is more faithful than reference or denotation (Bedeutung) and a natural candidate for the sense of a sentence is the set of its proofs — and this differs from the usual interpretation of sentences as sets of situations in which the sentence happens to be true. [7] From this proof-theoretical view, there are two natural ways to assert a universal statement.

One is the standard proof rule ($\forall_i$): for a variable x about which nothing is assumed you are able to infer $P(x)$, hence you can conclude $\forall x.P(x)$ (example: simply assuming that n is integer you show that there exists four squares whose sum is n, so you can conclude that every integer is the sum of four squares, or for more linguistic examples, with "*tout*" see [11]). Gentzen deductive systems NK or LK [8] give a clear account of this rule, and Hilbert generic element $\tau x.\ P(x)$ introduced in [10]. This is an ideal element that, with respect to P has nothing particular, so when it enjoys P so does every other element: $\forall x.P(x) \equiv P(\tau x.P(x))$. This τ that is an *in situ* quantifiers is also the dual of the better known ε operator that has been used for modelling definite and indefinite noun phrases— see e.g. [17]

The other natural rule, known as the ω-rule is quite different. It was introduced by Gentzen in [9] to establish the consistency of arithmetics: assume you have a proof of $P(n)$ for each n, then you can conclude that $\forall n P(n)$. This rule is closer to the model theoretic view, and it presupposes that the domain D is known, here $D = \mathbb{N}$. Observe that the ω-rule requires an infinite number of premisses, so a proof with an ω-rule has an infinite width, although any of its branches is finite.

The difference between the two rules $\forall_i$ and ω can be made intuitive as follows: the usual proof rule $\forall_i$ yields to statements that are true in *any* model, while the later rule ω only derives statements that are true in the intended model with domain D. Observe that there do exist statements that are true in one model and not in others: completeness theorem says that the formulae of first order logic that are true in any model are exactly the ones that are provable in first order classical logic; a non provable formulae can be true in one model and false in another model. There is also a structural difference: formulae and proofs cannot refer to entities in the model; although the logical language may include constants, those constants cannot properly for elements of models: elements of models vary from a model to another one, and furthermore an interpretation may map different constants onto a single element in the model. Hence these two views of quantification are quite different although they may coincide for a particular language and theory, in particular on a well-defined finite domain.

"*Chaque*" as a conjunction and "*tout*" as a generic In common French, as far as our intuition and data are correct (see below), it seems that *chaque* needs a precise the domain which on the other hand can be totally contingent. Exceptions are less welcome with *chaque* than they are with *tout* — the collective universal quantifier *tous les* is the one that better tolerates exceptions. [12] This is absolutely consistent with the interpretation of chaque as $\&_{x\in D}$. On the other hand, "*tout*" especially in "*tout X*" may be applied to a possibly vague class.

As opposed to "*chaque*", "*tout*" requires the assertion to be perennial in some sense, which prevents "*tout*" from applying to very particular classes that are not perennial as suggested in [11, 12]. This makes "*tout*" close to the proof theoretical $\forall x$ or better to the $\tau x.P(x)$. Observe that it is also close to the generic "*un*" in this respect.

Next, how do we refute an assertion with "*chaque*"? There is only one possibility which consists in finding one element that does not enjoy the property. This is consistent with "*chaque*" being a conjunction. Now how does one refute a "*tout*" assertion? One way is to exhibit an element a not satisfying the property, in the (often imprecise) domain D under consideration: this is a switch from a real quantification to a conjunction over the domain, and the asserter may object that a is not in the imprecise domain D he was thinking of. Another way is to object a "*tout*" assertion is to remain in the conceptual level, and to say that a subdomain of the domain of the "*tout*" does not enjoy the property. Here as well the asserter may object that they are not part of the intended domain, but it is going to be more difficult.

We explored a bit the proof theoretical interpretation of natural language quantification in [1].

Verifying our intuitions: ongoing experiments We have attempted to use corpora to substantiate our hypothesis, by looking for data in a dialog corpus of rather spontaneous speech (CID). Universal quantifiers were too rare to draw any conclusion though, and it seems necessary to deploy some specific experiments. First, we are testing the sensitivity of these quantifiers to different types of domains and most notably vague and precise ones. We expect a complementary distribution between *tout* and *chaque*. Second, we are testing how *tout* and *chaque* sentences are refuted. We test for (i) individual exceptions and (ii) type exceptions.

Our tests take the form of judgments elicitations in the first place. We are planning to create more elaborate experiments, where fillers and control sentences are used thus completing our questionnaire. This type of experiments will be finalized, once we will have sharpened the hypothesis with standard introspective methods. The design of the data base, the web programming of the questionnaires and the storage of the answers for statistics will be the project for two groups of four third year students, from January to May.

Future work There are further questions completing this study that we would like to develop.

Firstly we would like to compare the processing of quantification by standard subjects and dyslexic subjects, and children in particular. Indeed, a recent study on the difference between the understanding of negation (and to a lesser extend of Aristotle quantified sentences A E I O) by standard and dyslexic children has greatly helped to understand the human processing of such sentences. [6]

Secondly we would like to extend the study to "*tous_les*", a (the?) third wording of universal quantification in French [12], which in contrast with *tout* and *chaque* insofar as it refers to the domain as a whole. How does "*tous_les*" compare with "*tout*" and "*chaque*"? The same question may apply to "*les*" (although *les N* is considered to be a referential expression, rather than a quantificational one [4]), and to the generic "*un*" (which we can foresee close to "*tout*")

Thirdly we would like to also use experiments whereby subjects, after listening to a sentence, match pictures that are presented to them with the relevant sentence. Pictures are presented on the screen of an eye-tracker which records their eye glaze. This will allows us to gain some insights into how subjects understand quantifiers. We already used such experiments in a study showing that "*chaque*" in object position takes scope more easily than "*tous_les*" does in the same object position [2]

Concluding remark The difference between the "*chaque*" and "*tout*" proverbs in the title possibly comes from the actual existence of the domain of quantification, "*vins*" possibly being understood here as *barrels* — this is comforted by the dependency of the "*lie*" on the "*vin*" via "*sa*" — while the "*tout*" proverb seems to be speaking of the eternal essence of "*nuit*" — observe that "*jour*" also is an essence, introduced by the generic "*un*", hence not dependent on the "*nuit*" — which do not precisely determine the domain of the quantifier.

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QUD-construction via underspecified DRSs

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It is well known that QUD stacks à la Roberts are not flexible enough to handle attachment and anaphoric properties of texts. It has also very often been said that QUDs are not sufficiently restricted and therefore of little help. On the other hand QUDs are needed to an account of information structure, which is cross-linguistically applicable, for the prediction of prosody and they may provide an independent account of discourse structure and coherence. We provide a construction procedure for QUDs that overcomes the criticism and implements the benefits.

We start out with the basic assumption that for the interpreter of a discourse or text $S_1,\ldots,S_n$, the Q(uestion) U(nder) D(iscussion) Q_i that arises at stage $S_1,\ldots,S_i$ can in general be inferred only upon hearing/reading the statement S_{i+1} that is to be understood as an 'answer' to this question. We assume that questions Q are represented by sets of DRSs at least one member of which corresponds to a correct partial or complete answer to Q. An u(nderspecified) QUD Q_i is given by the logical form $< P, < K, K' >>$, where P is a set of presuppositions, and K and K' are DRSs such that (i) all free variables of $K \cup K'$ that are not declared in any of the presuppositions P must be declared in the DRS representing $S_1,\ldots,S_i$, (ii) some of the free variables of K' may be declared in K, (iii) but the set of free variables of K and the universe of K' are disjoint. Roughly speaking the DRS K contains the information of S_{i+1} that is already given[1] in the context of $S_1,\ldots,S_i$, and K' is a variable over DRSs with free discourse referents declared in the context, in K or in P. In this sense (and modulo accommodation of presuppositions) the uQUD contains DRSs that provide more information about discourse referents already introduced in the context.

The construction procedure is the following: At each stage i of the interpretation of a discourse there is a set of active questions, AQ_i, represented by uQUDs. Each AQ_i is triggered by discourse referents introduced by $S_1,\ldots,S_i$. Each type of discourse referent triggers a different type of question. Eventuality discourse referents trigger uQUDs of the form in (1), where ev_2 is free in K' and ρ some temporal relation. And (2) is the form for declarative uQUDs triggered by individual discourse referents. We call uQUDs of the form in (1) or (2) *basic* uQUDs. In each case K is determined by the subsequent sentence S_{i+1}.

(1) $\left\langle \left\{ \begin{array}{|c|}\hline \rho \\ \hline \rho \in \{\subseteq, <, >\} \\ \hline \end{array} \right\} , \left\langle \begin{array}{|c|}\hline ev_2 \\ \hline \rho(ev_1,ev_2) \\ \hline \end{array} \ , \ K'(ev_2) \right\rangle \right\rangle$ (2) $< \emptyset, K'(x)>$

[1] The type of givenness varies a lot and ranges from discourse-given to inferred.

UQUDs may become more specific by unification. For a discourse like *Alice entered the library. A man was sitting at a table. She greeted him*, we get the uQUD (3) by unification of the basic uQUDs triggered by u, v, e_1 and s_2.

(3) $\left\langle \begin{array}{|c|}\hline s_2\ e_3\ u\ v \\ \hline e_1{<}e_3 \quad e_3{\subseteq}s_2 \\ u{=}z \quad v{=}m \\ \hline \end{array} \ ,\ K'(u,v,e_3) \right\rangle$

Contrastive topics triggered by plural NPs may also be dealt with in this framework. Consider π_0*: The Montagues went out for dinner.* π_1*: Margot ate duck, and* π_2*: Richard had the donkey-meat.* The first sentence introduces a plural discourse referent X for the Montagues. It feeds expectations to learn more about X in the subsequent discourse. Let us assume that the occurrence of *eat* in the second sentence is given. Then the situation triggers the following question.

(4) $\left\langle \begin{array}{|c|}\hline y \\ \hline e_2{\subseteq}e_1 \\ e_2{:}eat(X,y) \\ \hline \end{array} \ ,\ K(y,e_2) \right\rangle$

Of course π_2 does not answer this question, because it tells us what Margot ate and not what the Montagues ate. To get a correct question, more precisely a set of correct questions, out of (4) we will apply a rule of optional distribution to it. This application will yield the set of questions $\{$ (4)[X/x] $\mid$ x $\in$ X $\}$, where (4)[X/x] is (4) with X replaced by x. In this set of questions x determines the contrastive topic and y the focus. If we now assume that X = m$\uplus$r, where m is the discourse referent for Margot, r represents Richard and $\oplus$ is the mereological sum operator, then this set can be paraphrased by the two questions *What did Margot eat?* and *What did Richard eat?*, each of them being a partial answer to (4).[2]

Our strategy to d-accessibility reflects SDRT's distinction between coordinating and subordinating discourse relations, but avoids the need for topic constructions. According to the temporal relation established by resolution of ρ uQUDs may be classified into narrative, backgrounding or elaborating ones.[3] Survival of uQUDs is then governed by the following principles.

– AQ_i and π_{i+1} answers $Q_{Bgrd}(e) \in AQ_i$, then $AQ_i \subseteq AQ_{i+1}$.
– AQ_i and π_{i+1} answers $Q_{Narr}(e) \in AQ_i$, then $AQ_i \cap AQ_{i+1} = \emptyset$.
– AQ_i and π_{i+1} answers $Q_{Elab}(e) \in AQ_i$, then $AQ_i \subseteq AQ_{i+1}$.
– If π_{i+1} does not answer any $Q \in AQ_i$, then no question in AQ_i survives.

[2]The mirror principle we adopt is the following: Suppose π and π' are the DRSs of subsequent sentences. Then we may enrich the universe of π' by summation over discourse referents (of the same type) in π and π'. These enrichments will then trigger corresponding questions.

[3]We will not consider other discourse relations of SDRT in this paper.

Generating Semantic Graphs from Image Descriptions for Alzheimer's Disease Detection

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Abstract

Semantic incoherences in discourse are often a forewarning sign of Alzheimer's disease. This study proposes to use Natural Language Processing to detect incoherences in descriptions of an image written by patients with Alzheimer's disease (ADs). We have collected 159 descriptions of the same image written by patients during their annual visits. A semantic parser generates a unique semantic graph *G* representing the descriptions of control patients. Our hypothesis is that the graph *G* is an exhaustive and coherent description of the image. Descriptions made by ADs can be matched against *G* in order to discover inconsistencies present in their descriptions. This will provide reliable measure to evaluate descriptions of patients whose diagnosis are unknown. We show in this paper, with the help of examples, how our approach combines the semantic representations of multiple descriptions of a given image and generates an ideal semantic graph containing features from all the input descriptions.

1 Motivations

Alzheimer is a brain degenerative disease which is increasing in the world's population due to its general ageing [Prince *et al.*, 2014]. Since no cure is currently known, it is crucial to detect the disease at its earlier beginning to develop strategies for reducing the risk of the disease and testing effective drugs.

Whereas clinical methods to detect Alzheimer's disease may be costly, unreliable and tardy, families often notice earlier signs of the disease through their daily language interactions with their elders. As a result, clinical researchers have lengthily studied ADs and controlled linguistic differences to detect the disease. One approach is to search for non-informative phrases and semantic incoherences. While several results confirmed that it significantly discriminates AD from controls[Nicholas *et al.*, 1985], a strong limitation to its application is the need of a trained linguist to annotate the incoherences.

In this study we evaluate an algorithm for discovering an exhaustive set of facts relevant for a particular image. This algorithm is the first step to automatically detect non-informative or semantically incoherent phrases in patients' descriptions. During their annual visits, a cohort of patients were asked to describe a standard image. We have collected 134 descriptions of the same image written by normal patients. Our algorithm generates a unique semantic graph G_{ideal} for the descriptions by using semantic parsing. G_{ideal} can be seen as an exhaustive and coherent description of the image. In a future work, we intend to match G_{ideal} against the semantic graphs generated from patients' descriptions whose diagnosis are unknown. Any facts in these descriptions not found in G_{ideal} will be considered as irrelevant and added in the set of non-informative / incoherent phrases and will be used to discriminate ADs.

2 Experiments

Our algorithm aims to create a unique semantic graph G_{ideal} of all relevant facts occurring in an image. We used a standardize image picturing a picnic scene on a bank of a lake for our experiment. To ensure the coherence of the facts described in the graph G_{ideal}, we selected all descriptions written by patients showing no medical evidences of dementia. Our algorithm parses each description independently and merges the resulting graphs within a unique semantic graph G_{ideal}. Each description taken individually mentions few facts about the image but by combining all descriptions in G_{ideal} we are assuming that all relevant facts will be eventually represented.

We parsed each description with the Knowledge Parser (K-Parser) [Sharma *et al.*, 2015]. The K-Parser takes as input an English sentence and produces a directed acyclic semantic graph. The nodes in the graph are divided into events (actions or verbs), entities (objects, people, etc.), and conceptual classes (such as *John* belongs to *person* class). The edges represent the semantic relations among the nodes (*e.g. agent, recipient*). 137 semantic relations are used in K-Parser. They are inspired from KM ontology [Clark *et al.*, 2004] or added as per the requirement to represent semantics of the natural language. A demonstration of K-Parser can be found at *www.kparser.org*.

Our algorithm merges the K-Parser outputs for multiple descriptions in a unique graph by following the two following steps.

Co-reference Resolution In this first step, all co-references within the descriptions are resolved. In a description, mentions of entities occurring in different sentences may referred to the same object of the discourse. During the resolution all phrases that refer to the same object are assigned with a unique ID. In sentences *"A boy rides a bike near the* $lake_1$*."* and *"A couple sits besides the* $lake_1$*."*, both words "lake" are indexed with the ID 1 to make explicit that they denote to the same object. The resolution is based on the similarity score between the possible co-referents. The score is computed by adding their *superclasses'* similarity (0 to 1), the equality of their part-of-speech tags (0 or 1) and the WordNet similarity [Pedersen *et al.*, 2004] (0 to 1) among them. If the final normalized score is above the threshold (>=0.75), the mentions are considered co-referents.

Description graphs merging Once all co-references are resolved, we merge all individual description graphs into a unique semantic graph. Our algorithm starts with an empty graph G_{comb}. All individual graphs are merged, one at a time, into G_{comb}. The merging function, detailed in the pseudo-code 1, shows that if G_{comb} is empty then G_{next}, *i.e.* the next description in the list is set as G_{comb}. Otherwise, each event/entity nodes of G_{comb} is compared with each event/entity nodes node of G_{next}. The comparison between nodes is done by the SIMILARTO function using the similarity score described in the previous paragraph. If the given two nodes have similarity score greater than the threshold (>=0.75), the UPDATE function merges the nodes and their children according to the following rules:

(1) If the similar nodes are events[1], the children of the event node in G_{next} are copied as children of the respective event node in G_{comb}. (2) If the similar nodes are entities or quality (*e.g. red*), nothing is done: either they are children of an event node in G_{next} and the rule (1) applies, or they are already present in G_{comb}.

If the similarity score between the given two nodes (node n_1 in G_{comb} and node n_2 in G_{next}) is <0.75, then the node n_2 is added to G_{comb} along with its children. Subgraphs of the ideal graph G_{ideal} built during this process are shown as examples at *http://bioai8core.fulton.asu.edu/alzheimer/*.

Algorithm 1 Inter-description Merging Algorithm

```
1: procedure MERGE(G_comb, G_next)        ▷ Merging two semantic description graphs for a given image
2:     if G_comb == φ then
3:         G_comb = G_next
4:     else
5:         for all node v_i ∈ G_comb do
6:             for all node v_j ∈ G_next do
7:                 if SIMILARTO(v_i, v_j) then
8:                     UPDATE(G_comb)
9:     return G_comb ▷ The combined Semantic Description Graph
```

[1](according to K-Parser's event definition, actions or verbs are events)

Evaluation We evaluated our algorithm on 10 descriptions selected randomly from our corpus. We created a gold standard by automatically merging these descriptions and manually corrected the semantic graph output. Our analysis of the differences between the gold standard and the automatic semantic graph reveals that 17 out of 22 events and 67 out of 82 entities were correctly merged. The prominent reason for the error was the viable but inaccurate interpretation of similarity among nodes. For example, the WordNet similarity between *"husband"* and *"wife"* is 0.88. It makes the combined node similarity measure to get over our system's threshold of 0.75.

The semantic graph obtained is, as expected, more detailed than individual graphs. Whereas a description simply mentioned a *"tree"*, when it is merged with other descriptions extra information about the tree are discovered: the tree is *"big"* and it is an *"oak tree"*. Among the 191 entity nodes which composed the semantic graph, 67 nodes were correctly added from different descriptions, that is 35% of the total number of nodes.

3 Conclusion & Future Work

In this paper we discussed a method to detect automatically the incoherences in discourse of patients with the Alzheimer's disease. The algorithm proposed combines multiple descriptions of the same image into a unique description. Our preliminary evaluation confirmed that, despite minor parsing errors, our algorithm is capable of building an exhaustive description of the image. We are currently extending the algorithm to match a description written by a patient, whose diagnosis is unknown, against the exhaustive description of the image in order to detect any incoherence and estimate the patient status.

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