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# Embodied Semantics 150 Years After Broca: Context-Dependent Negation in Novelistic Storytelling

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**Abstract** The present study capitalizes on recent advances in neurophysiology concerning the involvement of the sensory-motor system in language recognition and understanding during reading and listening so as to explain the various roles played by negation in novelistic descriptions since the medieval origins of the genre. Textual evidence from a famous medieval verse novel, Chrétien de Troyes' *Chevalier de la Charrette*, demonstrates that negation does not simply complicate the processing of a given description. Indeed, negative descriptions can be completely understood only if fully integrated in a complex context which entails the conceptual representation of the negated state of affairs.

KEYWORDS: Embodied Semantics; Negation; Narrative Description; Ecology of the Novel; Medieval Verse Novel.

**Riassunto** *La semantica incarnata 150 anni dopo Broca: la negazione contesto-dipendente nella narrazione romanzesca* – Questo studio approfitta delle ultime scoperte nel campo della neurofisiologia circa il coinvolgimento del sistema senso-motorio nel riconoscimento e nella comprensione del linguaggio durante l'ascolto e nel corso della lettura silenziosa per spiegare il senso variabile e articolato della negazione nella narrazione romanzesca fin dalle origini medievali del genere. Evidenze testuali estratte da un famoso romanzo medievale in versi, il *Chevalier de la Charrette* di Chrétien de Troyes, consentono di illustrare come la negazione non si limiti a complicare il processo di comprensione di una data descrizione. Infatti, il senso delle descrizioni negative può essere compreso nella sua complessità soltanto se completamente integrato in un contesto che implica di necessità la rappresentazione concettuale dei fatti e delle circostanze negate.

PAROLE CHIAVE: Semantica incarnata; Negazione; Descrizione narrativa; Ecologia del racconto; Romanzo medievale in versi.



## Negation in the Brain (and in the Body)

RECENT ADVANCES IN NEUROSCIENCE have shown that Broca's area, classically considered a motor speech-production area, is involved in the understanding of action and imitation and may have evolved for interindividual commu-

nication, both through gesture and speech.<sup>1</sup>

This major breakthrough has essentially confirmed the Motor Theory of Speech Perception making possible a revision of the theory based on new neurophysiological findings.<sup>2</sup> Some recent studies have argued that recognition and understanding of narrative

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language must be based on embodied knowledge which is elicited when reading or listening to stories.

Essentially, evidence of effector-specific motor responses to speech and activation of mirror matching circuits during the processing of action-related words and sentences while speaking, listening and reading throws open the door to an ecological theory of narrative description based on embodied semantics.<sup>3</sup> In fact, the understanding of narratives seems to rely on the reenactment of described events, which itself depends on congruent effector-specific motor responses.<sup>4</sup>

Indeed, action potential emerging from previous experience likely resonates in the body of the listener or the reader during the processing of corresponding narrative descriptions, which also explains why everybody responds differently to the processing of the same text.

Essentially, the ecology of the novel implies a theory of literary description based on embodied semantics, maintaining that the processing of described actions depends on somatotopically congruent sensory-motor responses. Empirical evidence showing that novels do not just describe actual actions such as “I bite an apple”, “I grasp a knife”, “I kick the ball” or “now I push the button” may confirm the effectiveness of this ecological approach to literature.<sup>5</sup> Opportunely, other experiments have also demonstrated modulation of motor system activity during the comprehension of language referring to events that are (apparently) unrelated to action.

“Milder” theoretical approaches have maintained that integrated systems aimed at processing language are deeply rooted in specific sensory-motor experience, but have developed both historically and ontogenetically through layer upon layer of abstraction, so as to handle concepts which are not embodied save through their history.<sup>6</sup>

Given that words referring to so called “abstract concepts” are typically and generally used without knowing anything about their etymology, patterns of increasing abstractions should not be considered as exclusively based

on metaphors. However, a more radical stance maintains that semantics and conceptual knowledge are much more integrated and rooted in individual action-related knowledge.<sup>7</sup>

Evidence confirming the latter view has emerged from studies which investigated linguistic processing during the performance of a repetitive hand-specific action aimed at transferring beans from a wide mouthed container to a target.<sup>8</sup> Interestingly, greater modulation of motor activity was found in hand muscles when subjects were reading sentences referring to “transfer” of both concrete objects and abstract information in comparison with responses to sentences not describing transfer. Such findings apparently support the idea that verbal descriptions of generalizations may relate to the embodied experience of specific (eventually prototypic) activities that fall within the conceptual field that these descriptions refer to.

A relevant array of evidence even supports the idea that the recognition and understanding of described emotions actually depend on resonance with previously embodied similar experiences. Glenberg and colleagues have shown that full understanding of language referring to emotional states requires those emotional states to be simulated, or partially induced, using the same neural and bodily mechanisms that are recruited during the corresponding experiences.<sup>9</sup> Essentially, language concerning emotions is grounded in emotional states of the body, and simulating those states is a prerequisite for the full understanding of the language that describes them.

Interestingly, the remark that introduces the paper in which Havas, Glenberg and Rinck present further evidence supporting this view suggests that «reading a passage from a favorite novel makes it clear that language evokes emotion».<sup>10</sup> Again, assuming that «there is no question that language and emotion affect one another», Glenberg and his collaborators observe that «when we read a novel, the words may thrill, petrify, or titillate».<sup>11</sup> According to such claims, a recent study discussed the case of emotion-related

language, according to Damasio's Somatic Marker Hypothesis and later neurophysiological evidence.<sup>12</sup>

The present investigation deals with another critical issue that represents an actual challenge for an ecological theory of the novel, that is, the understanding of negative descriptions. Traditional cognitive approaches still debate the rational or irrational nature of such descriptions, maintaining that they basically introduce alternatives to reality.<sup>13</sup>

According to views relying on the Embodied Cognition Framework, the understanding of narrative descriptions featuring events happening in the past, in the future, in dreams, while daydreaming or openly presented as desires, wishes or thoughts should depend on embodied action-related knowledge in the very same way as the processing of descriptions featuring events presented as taking place in the narrative "here and now" does.

Indeed, an ecological approach to the novel necessarily maintains that nothing can be told and narrated if it does not fall within the range of the human perceptual and interoceptive experience. Accordingly, the understanding of negative sentences should recruit individual embodied knowledge just as the processing of the corresponding affirmative descriptions of negated events does. Namely, the processing of negative descriptions must recruit a mental representation of the negated state of affairs.

On the whole, experiments investigating sentential negation have shown increased processing costs for negative versus affirmative utterances. More specifically, they have reported longer reaction times for negative versus affirmative sentences in a probe recognition task and shown that comprehension of negative clauses is more difficult compared to comprehension of affirmative sentences during lexical decision tasks.<sup>14</sup> Further investigation based on response-time experiments has also provided evidence for the fact that recognition and comprehension of negative sentences might rely on mental simulation of the negated situation, with negation not being

immediately incorporated into the processing of the negated expression.

Participants were required to read sentences of the type "The X is (not) above/below the Y" and were subsequently presented with a picture of the two objects mentioned in the sentence, either in the correct or in an incorrect spatial relation.<sup>15</sup> A negation-by-truth-value interaction was observed when the picture was presented without delay and a main effect of truth value was observed when the delay was 1500 ms, both response-time patterns being well known from studies employing a sentence-picture verification task. The two response-time patterns were observed even though the response-time-eliciting task did not require the computation of truth values, moreover the delay between presenting the sentence and the picture determined whether one or the other response-time pattern emerged.

Accordingly, the two different response-time patterns (interaction vs. main effect) do not depend on different processing strategies, being rather due to different stages of one and the same processing mechanism. That is, differences in response times do not seem to be reflecting differences in the time needed to compare the representation of the picture to the representation of the sentence. Rather they depend on the degree to which the processing of the picture is primed by the simulation processes carried out while understanding the sentence.

Another response-time study investigated whether understanding negative sentences implies an available representation of the actual state of affairs, clearly demonstrating that this is the case for negative sentences with contradictory predicates.<sup>16</sup> Indeed, subjects certainly developed an available representation of a closed door 1500 ms after reading a sentence such as "The door was not open". Such findings have been interpreted as supporting the idea that two contradictory states of affairs come to mind while processing a negative sentence, both indeed accessible in a representational format which is grounded in the sensory-motor system.

Moreover, participants in two experiments read negative sentences and subsequently responded to pictures of mentioned entities in the context of a recognition task.<sup>17</sup> Since responses following negative sentences were faster when the depicted entity matched rather than mismatched the negated situation, a mental representation of the negated situation was likely crucial to the understanding of the negative sentence. Such results have been interpreted as supporting the experiential-simulation view of comprehension, according to which the understanding of language relies on the embodied experience of the described items or events.

This array of evidence supports the idea that the negated state of affairs is actually simulated but not integrated with the representation of the described event while understanding negative descriptions.<sup>18</sup> According to this view, which hypothesizes reduced access to conceptual representations of negated items, reduced activations of the brain circuits involved in conceptual representations are to be expected.

In fact, a TMS experiment showed reduced activity within the neural system responsible for action-representation during the understanding of negative action-related sentences compared to the processing of the corresponding affirmative utterances.<sup>19</sup>

The activity within the action-representation system was specifically reduced for negative action-related vs. affirmative action-related sentences, compared to “abstract” sentences. These results very likely indicate that negation modifies the activation of sensory-motor systems responsible for the understanding of the corresponding affirmative descriptions. Namely, sentential negation transiently reduces access to cortical areas carrying mental representations of the negated information, causing a reduced access to semantic information to which the predicate of the negated propositions specifically refers.

Other recent experiments have however supported the somewhat opposite idea that longer response-times in the understanding of

counterfactual descriptions are due to the fact that negative sentences are syntactically more demanding than affirmative sentences. According to this view stronger activations of brain regions typically related to logical thinking and language processing are to be expected, as shown by a TMS study which provides evidence that the processing of negations during the comprehension of natural sentences generates more activation in left IPL than the processing of affirmative sentences.<sup>20</sup>

The same study also showed that a left perisylvian neural network synchronizes in order to resolve negations, especially whenever requirements for meaning integration are enhanced.

Such findings have been interpreted as consistent with the idea that the understanding of negative sentences requires more processing costs than the comprehension of affirmative sentences. According to this view, the processing of negative sentences implies that more demanding problem solving strategies are required for extracting the correct content of a negative sentence.

However, relevant evidence also supports the opposite idea that slow response times for processing negations does not just result from more complex logical inference, since a mental representation of the negated state of affairs is rather crucial to the understanding of negative descriptions.

### Embodied Processing of Novelistic Negations

Hence, mental representations of negated state of affairs likely rely on reduced activation of the neural circuits which are responsible for the understanding of actions when these negative descriptions include action-related language. Accordingly, the recognition and the understanding of complex negative utterances should imply reduced access to the incongruent sensory motor and perceptual responses.

This hypothesis might explain the remarkable effectiveness of some negative descrip-

tions which are typical of novelistic storytelling since the very origins of the genre, such as the following excerpt from the *Chevalier de la charrette* (vv. 3823-3835):

La parole oï Lanceloz,  
 Ne puis que li darriens moz  
 De la boche li fu colez,  
 Puis qu'ele ot dit: «Quant vos volez  
 Que il se taigne, jel voel bien,»  
 Puis Lanceloz por nule rien  
 Nel tochast ne ne se meüst,  
 Se il ocirre le deüst.  
 Il nel toche ne ne se muet;  
 Et cil fiert lui tant com il puet,  
 D'ire et de honte forssenez,  
 Quant ot qu'il est a ce menez  
 Que il covient por lui proier.<sup>21</sup>

Queen Guenièvre and King Bademagu of Gorre have just agreed to suspend the fight between her champion Lancelot and his son Meleagant, until it can be resumed one year later in the presence of King Arthur (vv. 3783-3812). Previous verses have made it clear that the agreement between Guenavere and Bademagu is public, so that Lancelot and Meleagant can hear what they are saying (vv. 3813-3815).

Moreover, Chrétien clearly stresses that Love requires the true lover to immediately obey the command of the beloved person, which explains why Lancelot immediately stops fighting after he hears the Queen and Bademagu agreeing to delay the combat (vv. 3816-3822). Responses to the processing of such a perceptual event, which imply an understanding of what Guenavere and Bademagu are saying, are described in the next 4 couplets, totaling eight verses, with four devoted to each character.

The first pair of couplets (vv. 3828-3831) describe Lancelot's reaction by means of three negative sentences. The first and the second are hypothetical utterances clearly stating that for no reason in the world, not even in a life-threatening circumstance, would Lancelot hit his opponent or even move. The third pro-

vides readers and listeners with the effect of this statement, presenting Lancelot as neither hitting his opponent nor moving.

The negated state of affairs, which should be somewhat present in the mental state of the audience, is fully described *per opposita* in the following verses, where Meleagant's reaction is openly stressed (v. 3832-3835). Indeed, Lancelot neither fights nor moves whereas Meleagant keeps hitting him with furious blows. The emotional states which underlie the reaction of both characters are clearly described, the love that Lancelot feels for the Queen being compared to the anger that motivates Meleagant when he realizes that his father is interceding on his behalf.

Essentially, both Lancelot's and Meleagant's activity patterns follow the linear scheme which leads from the emotional processing of a perceptual experience to an actual response which entails motor implications. Interestingly, the description of Lancelot's reaction employs negation in order to hinder the actualization of the latent action potential, whereas, the very same action potential is fully deployed in the subsequent description of Meleagant's actual response.

This textual evidence clearly shows that negation does not just complicate the processing of a given description, but rather plays a crucial role in discursive contexts which are completely understood only when fully integrated in a complex conceptual representation entailing the negated state of affairs. These complex descriptions seriously challenge the idea that the understanding of negative sentences simply entails more processing costs than the comprehension of affirmative sentences merely because the processing of negations implies a more demanding problem solving strategy for extracting the correct content of the sentence.

Indeed, the problem solving strategy required to fully understand the presented description does not just depend on negation, but rather involves the integration of negative utterances into a dialectic where opposite behavioral responses depending on different

emotional processing of the very same perceptual event are compared.

More specifically, the complete understanding of the described circumstance depends on the dialectic comparison between two different descriptions referring to opposite behaviors which fit the very same situation. It looks extremely likely that the negative description of Lancelot's reaction causes reduced access to sensory-motor responses which are then fully triggered by the following affirmative description of Meleagant's response. Further complexity clearly emerges from another interesting episode in the very same medieval novel, which calls into question other aspects related to the involvement of embodied experience in the understanding of negative descriptions (vv. 4570-4581):

Que por la gent de son ostel  
 Se fet las et se fet couchier;  
 Mes n'ot mie son lit molt chier  
 Que por rien il n'i reposast,  
 N'il ne poïst ne il n'osast,  
 Ne il ne volsist pas avoir  
 Le hardemant ne le pooir.  
 Molt tost et sœf s'an leva,  
 Ne ce mie ne li greva  
 Qu'il ne luisoit lune n'estoile,  
 N'an la meison n'avoit chandoile  
 Ne lanpe ne lanterne ardent.<sup>22</sup>

Negative descriptions present the interaction between the character and the environment in terms of invalidating the described facts, that is implicitly affirming that the opposite is "true". Lancelot acts as if he feels tired and eager to sleep, so as to convince the surrounding people of his pretended intentions. In truth, he does not plan to go to bed at all, since he would not be able to rest, nor could he or would he dare to, nor would he like to be able to or is he eager to rest.

The case of Lancelot simulating tiredness entails an empathic pattern such as "I think that they think that I feel tired" implying an additional layer of emotional perspectivism based on a second level theory of the mind.<sup>23</sup>

Readers and/or listeners are required to enact the "as if" state of the hero, who pretends to be tired and ready to go to bed, so that all the people who notice his presence in the hostel where he is supposed to rest will be convinced of his pretended intentions. In truth, Lancelot is about to leave his hostel for traveling to the place where Queen Guenièvre is secluded.

Hence, the hero quickly and cautiously stands up without complaining about the absence of the moon and the stars nor is he bothered by the lack of any candle, lamp or lantern in the house, since the darkness is favorable for his plan. Accordingly, readers and/or listeners are required to empathize with an emotional state of the character which is described in negative terms. Indeed, he not only experiences the willingness to be awake and the pleasure of being surrounded by darkness, but is rather unwilling to sleep and unperturbed by the lack of moonlight, starlight or any artificial light.

But why is describing a character as "willing to be awake" not the same as describing him as "unable to sleep"? Why is describing a night or a place as simply "dark" different than describing them as "moonless" and "lacking any starlight" or "lacking any source of light"? What is the narrative difference between the two descriptive styles and why do novelists adopt the latter in such circumstances since the very origins of the genre?

The banal answer is because they can, that is because natural language allows them to do so, whereas a more complex account might call into question a narrative strategy revolving around perspectivism and *amplificatio*. Indeed, the counterfactual description of the bed, the expected rest, the moon, the stars, the candle, the lamp and the lantern stress the subtle mismatch between desire and expectations, which makes all the difference between the actual and pretended situation. A mental representation of the negated state of affairs triggers special emphasis and facilitates the alternate adoption of multiple visual and emotional angles.

Other implications clearly emerge from

another episode of the very same novel, in which Lancelot is unable to attend the battle against the nasty Meleagant, who has locked him up in a tower. Negation plays a relevant role in the description of this situation, which features Lancelot complaining about his dramatic situation and Meleagant's sister, who left her castle so as to look for him (vv. 6552-6577):

Mes lors cele qui aval muse  
 Quanqu'il ot dit et entandu;  
 N'a plus longuemant atandu,  
 C'or set qu'ele est bien assenee,  
 Si l'apele come senee:  
 «Lancelot!», quanqu'el puet et plus,  
 «Amis, vos qui estes lessus,  
 Parlez a une vostre amie!»  
 Mes cil dedanz ne l'oï mie.  
 Et cele plus et plus s'esforce,  
 Tant que cil qui n'a point de force  
 L'antroi, si s'an merveilla  
 Que puet estre qui l'apela.  
 La voiz entant, apeler s'ot,  
 Mes qui l'apele il ne le sot:  
 Fantosme cuide que ce soit.  
 Tot entor soi garde et porvoit  
 Savoir se il verroit nelui;  
 Mes ne voit fors la tor et lui.  
 «Dex, fet il, qu'est ice que j'oi?  
 J'oi parler et neant ne voi!  
 Par foi, ce est plus que mervoille,  
 Si ne dor je pas, ençois voille.  
 Espoir, s'il m'avenist an songe,  
 Cuidasse que ce fust mançonge;  
 Mes je voil, et por ce me grieve».<sup>24</sup>

Chrétien makes use of negation for describing the reaction of Meleagant's sister after she has heard Lancelot's complaints, which prompt her to action. The damsel is described as "not waiting a long time" before calling Lancelot's name, the negative locution conveying the idea that she acts promptly (v. 6554). Interestingly, an affirmative clause describes the actual action of the damsel calling the name of the hero, whereas the next negative sentence describes the missing perceptual response

(v. 6560).

Indeed, Lancelot cannot hear the damsel, so that she has to call him more and more loudly before he realizes that a female voice is calling his name (v. 6565). Negation is used again for describing Lancelot as being unable to discern who is calling him, to the point that he ends up thinking that he has heard a phantom (vv. 6566-6567). Indeed, he unsuccessfully tries to integrate auditory and visual perception, a negative sentence describing his inability to see anybody around him (v. 6570).

The situation is clearly assessed in direct speech, so that the audience is provided with a perspectival description which clearly adopts the perceptual angle of the protagonist (vv. 6571-6577). Lancelot clearly states that he has heard a voice but sees nobody and feels scared since he is aware of the fact he is not sleeping, being instead wide awake. The very same state of affairs is described twice in a single verse (v. 6574) thanks to a negative clause immediately followed by the corresponding affirmative counterpart.

Lancelot openly states that he is worried about his mental state because he cannot simply dismiss his awareness of the voice calling him as a perceptual event simulated while dreaming. This complex description exerts negation in multiple circumstances, by emphasizing the mismatch between the actual situation and the way the character deals with it. Interestingly, the protagonist self-assesses his mental state clearly dismissing «mervoille», «songe» and «mensonge» as inappropriate explanations.

### ■ Negations are not all the same

Taken together, these descriptions from the *Chevalier de la Charrette* clearly show that negation can only be understood within a semantic context which completely changes from one episode to another. In sum, a medieval verse novel which is still clearly understandable some 800 years after its composition shows that negations are not always the same. Rather, any negative description presents a different case implying specific pro-

cessing strategies, even when extracted from a very particular context such as a highly formatted medieval verse novel.

The first text provides the audience with a negative description of an action which is not being performed by the hero, followed by an affirmative description of the very same action being performed by his opponent. The negated state of affairs is openly presented side by side with the activity pattern which it negates. Essentially, the author provides the audience with a mimetic description of the process that likely underlies the understanding of negative utterances.

The second describes a complex behavior on the part of the hero, who pretends to be tired and willing to go to bed so as to deceive the surrounding people, whereas he plans to capitalize on the absence of the moon, the stars and any artificial light to sneak away and go meet Guenièvre. The author employs negation for describing this deceptive behavior by stressing all items and events which are relevant to the understanding of the situation from different points of views. Basically, negation is part of a narrative strategy which emphasizes perspectivism, that is a narrative strategy favoring the adoption of specific perceptual and emotional angles on described events.

The third in a sense summarizes the evidence emerging from the previous episodes, since it presents a different case of perspectivism in which the actual state of affairs is described side by side with a missing perceptual event. Essentially, the state of affairs is only negated from the perceptual angle specific to the protagonist, which the audience is required to adopt so as to make sense of the episode. Hence, the understanding of negation and perspective-taking are part of the very same processing strategy required to grasp the meaning of a complex situation and to fully appreciate its dramatic extent.

Assuming that the sense of a description is completely understood only when all its parts are integrated, the idea that the processing of negations relies on specialized syntactic mod-

ules looks extremely unlikely. Indeed, the understanding of negations implies processing strategies which do not always resolve within the borders of a clause or a sentence. Indeed such understanding often requires a complex integration of wider textual segments whose boundaries are mainly recognized by readers and/or listeners thanks to non-linguistic features, such as prosody, rhyme or para-textual markers, namely paragraphs.

Literary texts provide selected audiences with narrative circumstances characterized by semantic complexity, which aims at facilitating a full understanding of multiple episodes at once, despite misleading appearances that might suggest the opposite. Deep integration of this semantic complexity makes evident that understanding negation cannot simply rely on logical processing of syntactic features. And it is very likely that basic linguistic utterances also require the reader or the listener to develop a representation of the negated state of affairs while processing negative sentences.

The idea that negation modifies the activation of sensory-motor systems responsible for the understanding of the corresponding affirmative descriptions allows for a comprehensive and appropriate interpretation of the evidence described above. Transiently reduced access to mental representations of negated information could explain all of the examples presented, despite the different role that negation plays in these varied semantic contexts. Indeed, in all cases negative descriptions would simply require reduced access to conceptual representations of the negated items or events.

If so, an ecological theory of the novel would explain why both affirmative and negative descriptions modulate sensory-motor responses in readers and/or listeners, requiring them to enact previous experience of described events. The difference in the understanding of affirmative and negative descriptions would depend on full or reduced activation of the brain circuits involved in emerging conceptual representations. These conclusions would provide additional support for the mo-



tor theory of speech perception and embodied semantics, providing an effective understanding of human linguistic communication, both spontaneous and artistically crafted.

In particular, literary theory is moving a crucial step forward in understanding why the novel became a global standard for storytelling and survived the invention of photography, cinema, television and multimedia broadcasting, and was crucial to the development of so-called web 2.0 (amazon.com mostly sells novels, doesn't it?).<sup>25</sup> The reason why novels continue to be attractive in the age of global communication is that the embodied processing of narrative descriptions entails direct involvement of the neural networks which are responsible for the actual experience of described perceptual events, emotions, and actions.

Essentially, what modern readers and the audiences of medieval novels in the XIIth and XIIIth century have in common is a region of the brain named after Paul Broca, which does not just recognize and regulate the production of linguistic descriptions, being also part of the neural networks that process the corresponding sensory-motor responses.

## Notes

<sup>1</sup> See M.A. ARBIB, G. RIZZOLATTI, *Neural Expectations: A Possible Evolutionary Path From Manual Skills to Language*, in: «Communication and Cognition», vol. XXIX, n. 3-4, 1997, pp. 393-424; G. RIZZOLATTI, M.A. ARBIB, *Language Within our Grasp*, in: «Trends in Neurosciences», vol. XXI, n. 5, 1998, pp. 188-194; M.C. CORBALLIS, *From Mouth to Hand: Gesture, Speech, and the Evolution of Right-handedness*, in: «Behavioral and Brain Sciences», vol. XXVI, n. 2, 2003, pp. 199-260; M.A. ARBIB, *From Grasp to Language: Embodied Concepts and the Challenge of Abstraction*, in: «Journal of Physiology-Paris», vol. CII, n. 1-3, 2008, pp. 4-20; M.A. ARBIB, *The Mirror System, Imitation, and the Evolution of Language*, in: C. NHANIV, K. DAUTENHAHN (eds.), *Imitation in Animals and Artifacts*, The MIT Press, Cambridge (MA) 2002, pp. 229-280; M.A. ARBIB, *From Monkey-like Action Recognition to Human Language: An Evolutionary Framework for Neuro-*

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<sup>2</sup> See A.M. LIBERMAN, I.G. MATTINGLY, *The Motor Theory of Speech Perception Revised*, in: «Cognition», vol. XXI, n. 1, 1985, pp. 1-36; A.M. LIBERMAN, D.H. WHALEN, *On the Relation of Speech to Language*, in: «Trends in Cognitive Neuroscience», vol. IV, n. 5, 2000, pp. 187-196; B. GALANTUCCI, A. FOWLER, A. CAROL, M.T. TURVEY, *The Motor Theory of Speech Perception Reviewed*, in: «Psychonomic Bulletin & Review», vol. XIII, n. 3, 2006, pp. 361-377.

<sup>3</sup> See A.P. FUKSAS, *The Embodied Novel. An Ecological Theory of Narrative Reference*, in: «Cognitive Philology», vol. I, n. 1, 2008, pp. 1-14; A.P. FUKSAS, *Characters, Society and Nature in the Chevalier de la Charrette (vv. 247-398)*, in: «Critica del Testo», vol. XII, n. 2-3, 2009, pp. 49-77; A.P. FUKSAS, *Embodied Abstractions and Emotional Resonance in Chrétien's Chevalier de la Charrette*, in: «Cognitive Philology», vol. IV, 2011, n. 1-14.

<sup>4</sup> See M. SALGARO, *Stories Without Words: Narratives of the Brain*, in: «Cognitive Philology», vol. II, 2009, pp. 1-8; M. SALGARO, *The Text as a Manual. Some Reflections on the Concept of Language from a Neuroaesthetic Perspective*, in: «Journal of Literary Theory», vol. III, n. 1, 2009, pp. 155-166.

<sup>5</sup> See M. TETTAMANTI, G. BUCCINO, M.C. SAC-CUMAN, V. GALLESE, M. DANNA, P. SCIFO, F. FAZIO, G. RIZZOLATTI, S.F. CAPPÀ, D. PERANI, *Listening to Action-related Sentences Activates Fronto-parietal Motor Circuits*, in: «Journal of Cognitive Neuroscience», vol. XVII, n. 2, 2005, pp. 273-281.

<sup>6</sup> See M.A. ARBIB, *From Grasp to Language: Embodied Concepts and the Challenge of Abstraction*, cit.

<sup>7</sup> See G. LAKOFF, M. JOHNSON, *Philosophy in the Flesh: The Embodied Mind and Its Challenge to Western Thought*, Chicago, University of Chicago Press, 1999; V. GALLESE, G. LAKOFF, *The Brain's Concepts: The Role of the Sensory-motor System in Reason and Language*, in: «Cognitive Neuropsychology», vol. XXII, n. 3, 2005, pp. 455-479.

<sup>8</sup> See A.M. GLENBERG, M. SATO, L. CATTANEO, *Use-induced Motor Plasticity Affects the Processing*

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<sup>9</sup> See A.M. GLENBERG, D.A. HAVAS, R. BECKER, N. RINCK, *Grounding Language in Bodily States: The Case for Emotion*, in: R. ZWAAN, D. PECHER (eds.), *The Grounding of Cognition: The Role of Perception and Action in Memory, Language, and Thinking*, Cambridge, Cambridge University Press, 2005, pp. 115-128.

<sup>10</sup> See D.A. HAVAS, A.M. GLENBERG, M. RINCK, *Emotion Simulation During Language Comprehension*, in: «Psychonomic Bulletin & Review», vol. XIV, n. 3, 2007, pp. 436-441.

<sup>11</sup> See A.M. GLENBERG, B.J. WEBSTER, E. MOUILSO, D. HAVAS, L.M. LINDEMAN, *Gender, Emotion, and the Embodiment of Language Comprehension*, in: «Emotion Review», vol. I, n. 2, 2009, pp. 151-161, p. 151.

<sup>12</sup> See A.P. FUKSAS, *Embodied Abstractions and Emotional Resonance in Chrétien's Chevalier de la Charrette*, in: «Cognitive Philology», 4, 2011, n. 1-14.

<sup>13</sup> See R.M. BYRNE, *The Rational Imagination and Other Possibilities*, in: «Behavioral and Brain Sciences», vol. XXX, n. 5-6, 2007, pp. 439-453 (and open peer commentary, pp. 453-480).

<sup>14</sup> See B. KAUP, R.A. ZWAAN, *Effects of Negation and Situational Presence on the Accessibility of Text Information*, in: «Journal of Experimental Psychology – Learning Memory and Cognition», vol. XXIX, n. 3, 2003, pp. 439-446; U. HASSON, S. GLUCKSBERG, *Does Understanding Negation Entail Affirmation? An Examination of Negated Metaphors*, in: «Journal of Pragmatics», vol. XXXVIII, n. 7, 2008, pp. 1015-1032.

<sup>15</sup> See B. KAUP, J. LÜDTKE, R. A. ZWAAN, *Effects of Negation, Truth Value, and Delay on Picture Recognition After Reading Affirmative and Negative Sentences*, in: B.G. BARA, L.W. BARSALOU, M. BUCCIARELLI (eds.), *Proceedings of the Twenty-Seventh Annual Conference of the Cognitive Science Society*, Erlbaum, Mahwah (NJ) 2005, pp. 1114-1119.

<sup>16</sup> See B. KAUP, J. LÜDTKE, R. A. ZWAAN, *Processing Negated Sentences with Contradictory Predicates: Is a Door that is not Open Mentally Closed?*, in: «Journal of Pragmatics», vol. XXXVIII, n. 7,

2006, pp. 1033-1050.

<sup>17</sup> See B. KAUP, R. H. YAXLEY, C. J. MADDEN, R. A. ZWAAN, J. LUEDTKE, *Experiential Simulations of Negated Text Information*, in: «Quarterly Journal of Experimental Psychology», vol. LX, n. 7, 2007, pp. 976-990.

<sup>18</sup> See B. KAUP, R. A. ZWAAN, J. LÜDTKE, *The Experiential View of Language Comprehension. How is Negation Represented?*, in: F. SCHMALHOFER, C.A. PERFETTI (eds.), *Higher Language Processes in the Brain: Inference and Comprehension Processes*, Erlbaum, Mahwah (NJ) 2007, pp. 255-288.

<sup>19</sup> See M. TETTAMANTI, R. MANENTI, P. A. DELLA ROSA, A. FALINI, D. PERANI, S. F. CAPPÀ, A. MORO, *Negation in the Brain: Modulating Action Representations*, in: «NeuroImage», vol. XLIII, n. 2, 2008, pp. 358-367.

<sup>20</sup> See J. BAHLMANN, J. L. MUELLER, M. MAKUUCHI, A. D. FRIEDERICI, *Perisylvian Functional Connectivity During Processing of Sentential Negation*, in: «Frontiers in Psychology», vol. II, 2011, art. 104, nn. 1-10.

<sup>21</sup> CHRÉTIEN DE TROYES, *Le chevalier de la Charrette (Lancelot)*, edited by A. FOULET, K. UITTI, Paris, Bordas, 1989, p. 216. The text is reprinted in multimedia digital format at *The Charrette Project* (<http://gravitas.princeton.edu/charrette/figura/ind ex.php>).

<sup>22</sup> CHRÉTIEN DE TROYES, *Le chevalier de la Charrette (Lancelot)*, cit., p. 258.

<sup>23</sup> See Concerning the theory of mind, the famous work of D.C. DENNETT, *Intentional Systems in Cognitive Ethology: The "Panglossian Paradigm" Defended*, in: «The Behavioral and Brain Sciences», vol. VI, n. 3, 1983, pp. 343-390, has been followed by many others in the fields of animal and human ethology, cognitive science and neuroscience. On explanations which rely on mirror neurons see in particular V. GALLESE, A. GOLDMAN, *Mirror Neurons and the Simulation Theory of Mind-reading*, in: «Trends in Cognitive Science», vol. II, n. 12, 1998, pp. 493-501. On perspectivism in medieval novels cfr. C. SEGRE, *What Bachtin Did Not Say: The Medieval Origins of the Novel*, in: «Russian Literature», vol. XLI, n. 3, 1997, pp. 385-409. The paper was originally published in Italian with the title *Quello che Bachtin non ha detto. Le origini medievali del romanzo*, in: C. SEGRE, *Teatro e romanzo*, Einaudi, Torino 1984, pp. 61-84. See also S. MARNETTE, *Narrateur et point de vue dans la littérature française médiévale. Une approche linguistique*, Bern, Peter Lang,

1998, in particular pp. 137-159 e 169-184, (chapters 5 e 6 which focus on the focalization of the novelistic point of view). Specific remarks concerning visual remarks and descriptive point of view in the *Chevalier de la Charrette* have been offered by

<sup>24</sup> CHRÉTIEN DE TROYES, *Le chevalier de la Charrette (Lancelot)*, cit., pp. 366-368.

<sup>25</sup> See A.P. FUKSAS, *The Long Tail of Digital Shelves*, in: «Critica del Testo», vol. X, n. 1, 2007, pp. 227-243.

N.J. LACY, *Thematic Structure in the "Charrette"*, in: «L'Esprit créateur», vol. XII, n. 1, 1972, pp. 13-18.