PSYCHOLINGUISTICS ACROSS THE BORDERS

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SPONSORS

REVIEW PANEL

24 June

15.30-16.30 Invited Talk A

17.00-18.45 Chairperson Roberto Zamparelli

25 June

15.30-16.45 Poster Session 2

16.45-18.30 Chairperson Maria Garraffa

ABSTRACTS

Enhanced Perception of Music Pitch in Chinese Speakers

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A comparison of music and language processing and representations shows a strong connection between melodic and intonational processing (Besson and Schön, 2001). Recent studies confirmed that music training facilitates the perception of subtle variations in pitch processing in music and language (Schŏ et al., 2004; Moreno and Besson, 2006), and that intonational familiarity helps to discriminate weak pitch violations in native language but not in a foreign language (Colombo et al., 2010). Speakers of tonal languages, like Mandarin, have been shown to be very sensitive to variations in pitch in monosyllabic words that also convey meaning differences. These tonal variations are instead less clearly perceptible to speakers of non-tonal languages (Bent et al., 2006).

The aim of the present study was to investigate whether the sensitivity acquired by speakers of Mandarin through language use may extend to discrimination of pitch differences in both musical and linguistic stimuli.

We tested 12 native Mandarin listeners and 12 native Italian listeners, all non-musicians in two tasks. The first was a Mandarin tone identification task (Bent et al. 2006) to verify the higher sensibility of the Mandarin listeners compared to the Italian group. The second task involved the discrimination of direction in pitch variation in music tones and monosyllabic Mandarin words and non-words (Stalinski et al., 2008).

All tasks revealed superior outcomes of native tonal language listeners. This advantage was particularly pronounced in musical tones variations. Results of this study suggest that use of pitch identification in tonal language listeners increases the sensitivity to melodic and prosodic differences.

Bent, T., Bradlow, A. R., & Wright, A. (2006). *Journal of experimental psychology: human perception and performance*, 32(1), 97-103.

Besson, M., and Schn, D., (2001), Comparison between language and music. *Annals of New York Academy of Sciences*, 930, 232-58.

Colombo, L., Deguchi, C., Boureux, M., Sarlo, M., and Besson, M. (2010) Detection of pitch violations depends upon the familiarity of intonational contour of sentences, *Cortex*, doi:10.1016/j.cortex.2010.03.008.

Moreno & Besson (2005). Influence of Musical Training on Pitch Processing: Event-related Brain Potential Studies of Adults and Children, *Annals of New York Academy of Sciences*, 1060: 93-97.

Schön D, Magne C, and Besson M. (2004). The music of speech: Music training facilitates pitch processing in both music and language. *Psychophysiology*, 41(3): 341-349.

Stalinski, S., Schellenberg, E.G., & Trehub, S. E. (2008). Developmental changes in the perception of pitch contour: distinguishing up from down. *Acoustical Society of America*, 124(3), 1759-1763.

Cascaded and thresholded processing in visual word recognition: is there a threshold at the letter level?

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Computational models of basic processes in reading usually implement either cascaded processing as in the dual route cascaded (DRC) model (Coltheart, Rastle, Perry, Langdon & Ziegler, 2001) or thresholded processing.

However, O'Malley and Besner (2008) recently proposed that readers might switch from cascaded processing to thresholded processing as a function of the experimental context (i.e., lexicalization hypothesis). Specifically, when only words are presented in a reading aloud task, processing would flow in a purely cascaded fashion; when words and nonwords are mixed together and a nonword may activate a word form representation enough to be erroneously read as a word, participants would threshold the output of the letter level to prevent lexical capture of nonwords.

According to the authors, this hypothesis is suggested by the fact that stimulus quality (SQ) and word frequency interact when only words are presented, whereas they exert additive effect when words and nonwords are randomly mixed in a reading aloud task. Moreover, when the experimental list includes both words and nonwords, stimulus lexicality and SQ have additive effects on reading-aloud RTs.

We argue that lexical capture might in fact occur when SQ is reduced, but this variable has its effect at the visual-feature level (i.e., a visual feature takes longer to resolve when its contrast with the background is low) and it is thus not clear why the authors proposed to threshold the subsequent letter level. The aim of the present study is to

directly test the lexicalization hypothesis by manipulating a variable that would have an effect at the letter level (Total Letter Confusability) and a variable that would have an effect at the orthographic-lexical level (lexicality: word vs. nonword). To achieve our goal we exploited a measure of letter similarity: the greater the visual similarity between two letters is, the more likely one of these letters will be confused with the other. For any given letter, its confusability values with the remaining letters of the alphabet can be averaged to obtain a measure of that particular letters confusability. For any given string of letters, its Total Letter Confusability can be computed as the sum of the confusabilities of the individual letters in the string.

Implications for processing involved in visual word recognition as well as for computational models of reading will be discussed.

Coltheart, M., Rastle, K., Perry, C., Langdon, R., & Ziegler, J. (2001). DRC: A dual route cascaded model of visual word recognition and reading aloud. *Psychological review*, 108, 204-256.

O'Malley, S., & Besner, D. (2008). Reading Aloud: Qualitative Differences in the Relation Between Stimulus Quality and Word Frequency as a Function of Context. *Journal of Experimental Psychology: Learning, Memory, and Cognition*, 34 (6), 1400-1411.

Syllable frequency and phonological neighborhood density effects in pseudo-word production in aphasia and healthy participants

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Introduction. Neurolinguistic and psycholinguistic studies provided converging evidence in favor of syllable-sized phonetic plans retrieved during phonetic encoding. Especially, syllable frequency affected production accuracy in brain-damaged speakers with apraxia of speech (Aichert and Ziegler; 2004; Staiger and Ziegler, 2008; Laganaro, 2008, but see Stenneken et al, 2005 and Laganaro 2005 for similar effects reported with patients with impaired phonological encoding) and spoken production latencies (RTs) in healthy participants (Cholin et al., 2006; Laganaro & Alario, 2006). However, a possible confound variable, phonological neighborhood density of the stimuli, was not controlled in these studies. These two variables might be linked, as words from dense phonological neighborhood share sub-lexical units which are bound to be of high frequency. As facilitatory effects of phonological neighborhood density have also been reported in the literature (Gordon, 2002; Vitevitch, 2002), your central interest here concerns the independence of those variables and of the encoding processes they are thought to affect. We use multiple regression approaches with both aphasic errors and RTs from healthy participants to examine whether these two factors can be dissociated.

Method. The experimental stimuli were 160 di-syllabic pseudo-words, composed by associating syllables covering a large frequency space in the French database LEXIQUE (New et al., 2004). Twelve aphasic patients producing phonological and/or phonetic errors in spontaneous speech underwent a pseudo-word reading and repetition tasks. 24 healthy participants had to read aloud pseudo-words.

Results. Accuracy data from patients were fitted with a Logit mixed model (Jaeger, 2008) and RTs with a linear mixed model (Baayen et al., 2008). Each model included patients and items as random effect variables. Both syllable frequency and phonological neighborhood density were significant predictors of patients accuracy and healthy participants RTs. Note that only the frequency of the first syllable predicted RTs. The interaction was never a significant predictor. Moreover, a multiple case analysis was run in order to explore the possible distinction between syllabic frequency and phonological neighborhood effects. Both factors affected the production of one patients; nine presented merely an effect of syllabic frequency and one patient was affected by phonological neighborhood density alone.

Conclusion. Both syllable frequency and phonological neighborhood density affected production latencies in healthy controls and accuracy in the group of patients. Syllable frequency is the quasi-systematic predictor of production accuracy in the multiple case analyses, indicating that its effect can be dissociated from phonological neighborhood density effect. The absence of interaction as significant predictor of the RTs was also in line with this suggestion.

Aichert, I., & Ziegler, W. (2004). Syllable frequency and syllable structure in apraxia of speech. Brain and Language, 88, 148-159. Baayen, R.H., Davidson, D.J. & Bates, D.M. (2008). Mixed-effects modeling with crossed random effects for subjects and items. Journal of Memory and Language, 59, 390-412. Cholin, J., Levelt, W.J.M. & Schiller, N.O. (2006). Effects of syllable frequency in speech production. Cognition, 99, 205-235. Gordon, J. K. (2002). Phonological neighborhood effects in aphasic speech errors: spontaneous and structured contexts. Brain & Language, 82, 113-45. Jaeger, T.F. (2008). Categorical data analysis: Away from ANOVAs (transformation or not) and towards Logit mixed models. Journal of Memory and Language, 59, 434-446. Laganaro, M. (2005). Syllable frequency effect in speech production: evidence from aphasia. Journal of Neurolinguistics, 18, 221-235. Laganaro, M. (2008). Is there a syllable frequency effect in aphasia or in apraxia of speech or both? Aphasiology, 22, 1191-1200. Laganaro, M., & Alario, F.-X. (2006). On the locus of the syllable frequency effect in speech production. Journal of Memory and Language, 55, 178-196. New, B., Pallier, C., Brysbaert, M., & Ferrand, L. (2004). LEIXQUE 2: A new French lexical database. Behavior Research Methods, Instruments, & Computers, 36, 516-524. Staiger, A. & Ziegler, W. (2008). Syllable frequency and syllable structure in the spontaneous speech production of patients with apraxia of speech. Aphasiology, 22, 12011215. Stenneken, P., Hofman, M. & Jacobs, A.M. (2005). Patterns of phoneme and syllable frequency in jargon aphasia. Brain and Language, 95, 221-222. Vitevitch, M. S. (2002). The influence of phonological similarity neighborhoods on speech production. Journal of Experimental Psychology: Learning, Memory, and Cognition, 28, 735-747.

CAN ITALIANS USE LEXICAL STRESS INFORMATION BEFORE SEGMENTAL INFORMATION TO RECOGNIZE SPOKEN WORDS?

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Italian polysyllabic words have lexical stress on one of the last three syllables. The most common stress is on the penultimate syllable (80% of words). Tagliapietra and Tabossi (2005) showed that Italian listeners use lexical stress information during lexical access. Reinisch and colleagues (2009) showed that Dutch listeners use stress information before segmental information to drive word recognition and the most important acoustic feature for them is the vowel duration.

Can Italian listeners also use stress information to drive recognition processes before segmental information is available? If so, what information do they use? It also is unclear which acoustic correlates Italian listeners use to detect stress during word recognition (Alfano, 2006).

Using the printed word eye-tracking procedure, we investigated if Italian listeners use stress before segmental material in word recognition and which acoustic information they use to perform lexical access. Participants heard a sentence ending with a target word and at the same time they saw 4 printed three-syllabic words on the screen: a target, a competitor, and two distractors. Target and competitor shared the first two syllables, but they had a different stress pattern (ZIgomo - ziGOte). People had to click on the target word with the mouse. Eye movements were recorded.

Proportions of fixations on target and competitor were analyzed within the first two syllables of the stimuli (where target and competitor were overlapping). Listeners, before hearing different segmental material, looked at the target more frequent then the competitor, both with antepenultimate stressed targets, and penultimate stressed targets. No

difference was found comparing antepenultimate and penultimate stress targets.

Correlations between behavioral measures and acoustic correlates of stress showed that duration of the first syllable (r=.29) for penultimate stress targets, and pitch (r=.35), and spectral tilt (r=-.46) of the second syllable for antepenultimate stress targets are important to distinguish between target and its competitor and distractors. A backward regression model confirmed these findings.

Italian listeners can use lexical stress to recognize words, before segmental information is available (Reinisch, Jesse, & McQueen, 2009); the variety of acoustic cues is involved at different moments in time in lexical stress disambiguation.

Alfano, I. (2006). In Savy, R. and Crocco, C. (eds). La percezione dell'accento lessicale: un test sull'italiano a confronto con lo spagnolo. *Proc. 2nd AISV*, Salerno, 632-656.

Reinisch, E., Jesse, A., & McQueen, J. M. (2010). Early use of phonetic information in spoken word recognition: Lexical stress drives eye movements immediately. *The Quarterly Journal of Experimental Psychology*, 63, 772-783.

Tagliapietra, L., & Tabossi, P. (2005). Lexical stress effects in Italian spoken word recognition. *XXVII Annual Conference of The Cognitive Science Society*, 2140-2144.

The production of Italian regular and sub-regular verbal forms

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Introduction. The debate on the mental representation of inflected words is characterized by the contrast between symbolic models (Clahsen, 1999), which maintain that regular forms are processed through a decompositional route, while irregular forms are retrieved as whole words, and connectionist models (Plunkett & Marchman, 1991), which claim that a single associative mechanism accounts for processing of both regular and irregular forms.

According to symbolic models, the phonological similarity should affect only the processing of irregular verbs. However, the Italian verbal system includes groups of sub-regular verbs, which share morpho-phonological features and follow the same sub-regular pattern (Laudanna, 1999; 2007). Investigating whether such verbs are processed like regular or irregular ones is the goal of our research.

We carried out an experiment on production of inflected forms belonging to the inflectional classes of Italian 2nd and 3rd conjugations. Both these classes include sub-regular verbs but, while the 2nd conjugation is mostly irregular, the 3rd is predominantly regular. We tried to verify whether the production of both regular and sub-regular verbs is influenced by phonological similarity to other verbs.

Method. In a RSVP task, participants were given a sentence context where, in a target position, they had to produce the inflected form of a verb, given its infinitive form. The experimental stimuli to be produced were regular and sub-regular forms of the 2nd and the 3rd conjugations. For each experimental regular verb, a morpho-phonologically similar sub-regular verb of the same class was selected (e.g., the regular verb DEFINIRE (to define), was matched with the sub-regular PROVENIRE (to come from)). A control list of regular verbal forms

not similar to other sub-regular verbs of the same conjugation (e.g. COMPIERE (to carry out)) was also created. Experimental and control lists were balanced for frequency of lemma and inflected form in written Italian (according to the CoLFIS; Bertinetto et al., 2005), frequency of form in the spoken Italian (according to the LIP, De Mauro et al., 1993), length in letters, in syllables and in phonemes, and number of prefixed verbs. The sentence contexts associated with experimental and control verbs were structurally similar.

Results and Discussion. The results showed an inhibitory effect of morpho-phonological similarity, with slower reaction times on sub-regular verbs than on regular ones which, in turn, were slower than control verbs. Within the 3rd conjugation, we observed longer reaction times and more errors on sub-regular than on experimental and control regular verbs. For 2nd conjugation, we obtained longer reaction times and more errors on experimental regular and sub-regular verbs than on control verbs. This differences between the two inflectional classes might be due to their distributional properties. We hypothesize that the predictability of inflectional patterns does not depend on their regularity, but on the numerosity and the frequency of verbs belonging to the same morpho-phonological family.

Bertinetto, P.M., Burani, C., Laudanna, A., Marconi, L., Ratti, D., Rolando, C. and Thornton, A.M. (2005). *Corpus e Lessico di frequenza dell'Italiano Scritto (CoLFIS)*.
http://alphalinguistica.sns.it/CoLFIS/CoLFIS_Presentazione.htm.
Clahsen, H. (1999). Lexical entries and the rules of language: A multidisciplinary study of German inflection. *Behavioral and Brain Sciences*, 22, 991-1060.
De Mauro, T., Mancini, F, Vedovelli, M., and Voghera, M. (1993). *LIP: Lessico di frequenza dell'Italiano parlato*. Milano, Etaslibri.
Laudanna, A. (1999). Regular versus irregular inflection: a question of levels. *Behavioral and Brain Sciences*, 22, 1028-1029.
Laudanna, A. (2007). Representation and processing of regular and sub-regular verbal forms in Italian. *Lingue e Linguaggio*, 2, 227-246.
Plunkett, K., and Marchman, V. (1991). U-shaped learning and frequency effects in a multi-layered perceptron: Implications for child language acquisition. *Cognition*, 38, 43-102.

Neural correlates of emotion word processing: the complex relation between emotional valence and arousal

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Emotion is characterised by a two-dimensional structure: valence describes the extent to which an emotion is positive or negative, whereas arousal refers to the intensity of an emotion, how exciting or calming it is. Emotional content of verbal material influences cognitive processing during lexical decision, naming, emotional Stroop task and many others.

Converging findings showed that emotionally valenced words (positive or negative) are processed faster than neutral words, as shown by reaction time and ERP measures, suggesting a prioritisation of emotional stimuli (Scott et al., 2009).

Contrasting results were found though when comparing positive and negative words. Some authors found a slowdown in processing negative words compared to positive and attributed it to automatic vigilance (Algom et al., 2004). Those studies failed to control for important lexical and semantic features which might have confounded the results (Larsen et al., 2006).

Furthermore, only one dimension of emotion, valence, has been repeatedly manipulated. Arousal has often not been considered or has only been controlled (Kanske & Kotz, 2007; Kissler et al., 2009).

The aims of our studies were to disentangle the effects of valence and arousal by manipulating both of them in a lexical decision task (LDT); to quantify the extent to which emotion affects lexical processing beyond other lexical and semantic variables; to determine at what stage of processing emotional effects take place by measuring EEG. A LDT was chosen because it is a direct measure of lexical access and it was the most commonly used in the studies reviewed.

Reaction time results revealed a main effect of arousal and an interaction between emotional valence and arousal: high arousal words were responded to faster than low arousal words, and this difference was much more pronounced for negative words compared to positive words. No significant difference between positive and negative words was found. Also, a regression analysis showed a unique contribution of the emotion factor in predicting lexical decision latencies, beyond other variables.

ERP results also showed an interaction between the two emotional dimensions around 200-300 ms, as indexed by a posterior negative component (EPN), with higher amplitude for negative low arousal words and positive high arousal words compared to negative high arousal and positive low arousal ones. This complex interaction will be interpreted according to Robinson et al. (2004). It is important to mention though that valence and arousal interacted at an early stage of processing, when we are accessing our mental lexicon. The EPN has repeatedly been shown to index discrimination between valenced and neutral stimuli, but no relation between valence and arousal has previously been investigated.

These findings highlight the importance of arousal, which interacts with valence, and suggest the possibility to integrate emotion in models of lexical access. This research more generally contributes to understanding how the emotional dimensions interact and therefore has implications beyond psycholinguistics, for research on emotion, affective disorders, neuropsychology and rehabilitation.

Algom, D., Chajut, E. & Lev, S. (2004). A rational look at the emotional Stroop phenomenon: A generic slowdown, not a Stroop effect. *Journal of Experimental Psychology*, 133, 323-338. Kanske, P. & Kotz, S.A. (2007). Concreteness in emotional words: ERP evidence from a hemifield study. *Brain Research*, 1148, 138-148. Kissler, J., Herbert, C., Winkler, I. & Junghofer, M. (2009). Emotion and attention in visual word processing - An ERP study. *Biological Psychology*, 80, 75-83. Larsen, R.J., Mercer, K.A. & Balota, D.A. (2006). Lexical characteristics of words used in emotional Stroop experiments, *Emotion*, 6, 62-72. Robinson, M.D., Storbeck, J., Meier, B.P. & Kirkeby, B.S. (2004). Watch out! That could be dangerous: Valence-arousal interactions in evaluative processing. *Personality and Social Psychology Bulletin*, 30, 1472-1484. Scott, G.G., O'Donnell, P.J., Leuthold, H. & Sereno, S.C. (2009). Early emotion word processing: Evidence from event-related potentials. *Biological Psychology*, 80, 95-104.

Relativised Minimality effects in Mocheno left periphery

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In Mocheno, a Tyrolean dialect in which the V2 rule coexists with a split CP (as Old Romance, Benincà 2006), Relativised Minimality (RM) effects arise between a topicalised (syntactically a left dislocation) and a focused verb argument, starting out from the underlying order *subject-indirect object-direct object.* As shown in (1a,b), a focused direct object can be preceded by both topicalised verb arguments, a focussed indirect object can be preceded only by a topicalised subject (1c,d) and a focussed subject cannot be preceded by any topicalised verb argument (1e,f).

(1)   a. En de Maria$_i$ A PUACH hot-er-*(en$_i$)   kaft   (ont net a
         to the Maria-IO a book-DO has-SUBJ CL-DAT CL bought (and not a
         penna)
         pen)
         'It was a book that he bought for Mary and not a pen.'

     b. Der Nane$_i$ A PUACH hot-*(er$_i$)   kaft   en de Maria (ont net a
         the John-SUBJ a book-DO has-SUBJ CL bought to the Mary   (and not a
         penna)
         pen)
         'It was a book that John bought for Mary, not a pen.'

     c. Der Nane$_i$ EN DE MARIA hot-*(er$_i$)   kaft   s   puach (ont net en
         the John   to   the Mary-IO has-SUBJ CL bought the book   (and not to
         Luca)
         Luca)
         'It was for Mary that John bought a book, and not for Luca.'

     d. * A puach$_i$ EN DE MARIA hot-er-*(z$_i$)   kaft   (ont net en
         * a book-DO to   the Mary-IO has-SUBJ CL-ACC CL bought (and not to
         Luca)
         Luca)
         'It was for Mary that he bought a book, and not for Luca.'

     e. * Z   puach$_i$ DER MARIO   hot-z$_i$ kaft   (ont net der Nane)
         * the book-DO the   Mario-SUBJ has-ACC CL bought (and not the John)
         'It was Mario who bought the book, and not John.'

f. * En de Maria$_i$ DER MARIO hot-en$_i$ kaft a puach (ont net der
* to the Mary-IO the Mario has-DAT CL bought a book (and not the
Nane)
John)

'It was Mario who bought Mary a book, and not John.'

The facts in (1) are unexpected under the latest version of RM (Rizzi 2004), according to which no RM effects arise between focus and topic, since they belong to two featural classes (Quantificational and topic classes). Moreover, in Mocheno no RM effects arise between topic and interrogative wh-elements. In my talk, I will show that this asymmetry between operators does not have to be taken as an instance in favour of a split inside the Quantificational class, but depends on the structure of Mocheno left periphery. Lack of RM between topic and operator is possible iff i) multiple TopicPs are available and ii) each TopicP is specialised for constituent category: this structural requirement is met only in main wh-interrogative clauses. When i) only one TopicP is available and ii) this TopicP is not specialised for constituent category, as in the case of foci, RM effects between topic and operator arise.

Mocheno data are of relevance not only for the theory of RM, since they indicate that the main condition for RM effects not to arise is the presence in the left periphery of a dedicated projection for the moved XP, but also for the analysis of reversible sentences in aphasia within an approach in terms of RM (Garraffa & Grillo, 2008), where the role of the intervener rather than the structure of the left periphery is considered.

Benincà, P. (2006), On the Functional Structure of the Left Periphery of Medieval Romance, in: R. Zanuttini et al. (ed.) *Negation, Tense and Clausal Architecture: Cross-linguistic Investigations.* Georgetown University Press, 53-86.

Garraffa, M., & Grillo, N. (2008), Canonicity Effects as grammatical phenomena. *Journal of Neurolinguistics* 21, 177-197.

Rizzi, L. (2004) Relativized Minimality. in: A. Belletti (ed.), *Structure and Beyond. The cartography of syntactic Structure.* Volume 3. Oxford/New York: Oxford University Press, 223-251.

Interaction between acoustic analysis and language-specific representations in vowel perception in the native language: an ERP study

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The mismatch negativity (MMN) to speech sounds is known to reflect acoustic distance and language-specific phonemic representations (Winkler et al., 1999, Cheour et al., 1998). We investigated the effects of acoustic distance and of speaker variability on the pre-attentive and attentive processing of French vowels by French adult speakers. The auditory sequence included 4 vowels; /u/ (standard), and /o/, /y/ and /ø/ as deviants that were produced by 3 different speakers. The vowel /o/ is closer to /u/ than the other deviants, and the three deviants differ from /u/ in different formant dimensions (/o/ in F1, /y/ in F2 and /ø/ in both). Electroencephalogram (EEG) was recorded while participants watched a silent movie (Passive condition) and discriminated deviant vowels (Active condition).

In the Passive condition, MMN amplitude was smallest to /o/ and MMN latency was shortest to /y/, thereby reflecting acoustic distance and suggesting different effects of F1 and F2. Most importantly, the MMN was elicited by all the deviant vowels without effects of speaker variability. In the Active condition, error rates were higher for /o/ and /y/ than for /ø/ and reaction times were slower for /o/ than for /y/ and /ø/. Moreover, N1 was smaller (perceptually close) and N2 was larger (high task difficulty) for /o/ than for the other deviants.

Importantly, the Vowel by Speaker interaction was significant in the Active condition (error rates, RTs and the N1 and N2 components of the ERP) but not in the Passive condition (MMN amplitude and latency), showing that subtle within-category differences are processed only when listeners pay attention to the stimuli.

Overall results showed that vowels are categorized pre-attentively according to phonemic representations in the native language independently of speaker variability. By contrast, participants are sensitive to between-speaker differences at the attentive level of vowel processing. These results are also compared with data from Italian native speakers (/u/ and /o/ are Italian vowels, but /y/ and /ø/ are not) and discussed in view of further cross-linguistic study.

Cheour, M., Ceponiente, R., Lehtokoski, A., Luuk, A., Allik, J., Alho, K., & Ntnen, R. (1998). Development of language-specific phoneme representations in the infant brain. *Nature Neuroscience*, 1(5), 351-353.

Winkler, I., Lehtokoski, A., Alku, P., Vainio, M., Czigler, I., Cspe, V., Aaltonen, O., Raimo, I., Alho, K., Lang, H., Livonen, A., & Ntnen, R. (1999). Pre-attentive detection of vowel contrasts utilizes both phonetic and auditory memory representations. *Cognitive Brain Research*, 7, 357-369.

ARE THE MECHANISMS THAT PROCESS RECURSION IN NATURAL LANGUAGE ALSO USED TO PROCESS A SYMBOLIC RECURSIVE GRAMMAR?

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Hauser, Fitch & Chomsky (2001) assume the human faculty of language (in a narrow sense) is marked by the capability of processing recursive structures. Nevertheless some studies suggest that animals also can process recursive structures. For example, Genter et al. (2006) found that starlings are able to classify sequences from recursive centre-embedded grammars. However, Corballis (2007) comments that the experimental stimuli used to verify recursion on animals can be processed with counting strategies, without the need of a recursive mechanism.

Our aim is to understand if a symbolic recursive grammar is processed by humans by means of the same neurocognitive mechanisms used to process natural language. Syntactic violations elicit a biphasic ERPs pattern (LAN-P600) and phrase structure violation an eLAN (Friederici 2002). We studied whether a structure violation of a well known formal Context Free Grammar elicits a similar neural response. We decided to use the system of brackets used in mathematics and informatics that is clearly recursive and well known by people.

We have recorded EEG while participants were presented with correct sequences of brackets '(())()' and violations '())())'. All phrases contained six brackets with a maximum embedding of three. This could allow participants to solve the problem with a counting strategy. However, since brackets grammar is logically recursive we assume that if the recursion cognitive system used for natural language can be also used to parse non-linguistic hierarchical structures this will likely be the case for brackets grammar. Each phrase was sequentially presented with letters as fillers and acceptability judgements were asked.

The comparison between phrase structure violations (extra close bracket) and grammatical control did not show any (left) frontal negativity, while effects emerged only at more posterior sites. The effects can be interpreted as an interplay between positivities for expected close brackets (P3) and negativities related to memory-load context update processes (slow negative wave). The whole ERP pattern can be coherently described within a model of central attention processing of expectable contexts proposed by Kok (2001).

Within the assumption that eLAN is a signature of the failure of correct phrase embedding within natural language we showed that a correspondent violation of a formal recursive grammar can be processed by humans by using a different cognitive mechanism. This questions the logic that the processing of an abstract recursive structure has to be necessarily performed by the same cognitive mechanism used for processing recursive linguistic structures.

Corballis MC (2007), Recursion, language, and starlings, *Cognitive Science*, 31(4), 697-704.

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False belief understanding and children's capacity for explanations

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According to a pragmatic language perspective, an explanation can be defined as an interactive move whereby the speaker offers the partner a new piece of information concerning an object of common attention, in order to produce a re-organization of the partner's knowledge about that object or event (Barbieri, 1989).

If the reorganization of the partner's knowledge is the main goal of explanations, then we can expect that their development is somehow related to ToM development; because the speaker has to take into account, at least to some extent, the state of knowledge of the partner. This study investigates the relationship between explaining capacity and ToM development, following the hypothesis that theory of mind helps children to understand when explanations are required.

Method

Participants- 85 preschool children, 41 boys and 44 girls, mean age 51.13 months (range 36-60 months).

Tasks and Materials- Children were presented with: 1) the Sally & Anne task (Wimmer & Perner, 1983); 2) the Vocabulary subscale from the *WPPSI* (1973, Wechsler, ed. OS, Firenze) and 3) an Explanation task, where they were asked to help a little extraterrestrial child to understand what was going on in different situations, each one depicted in a drawing. In the Ignorance-condition children were told that their interlocutor did not understand the situation depicted, while in the False belief-condition children listened to him providing a wrong explanation of the situation.

Results

In the False belief condition a 2 Sally-Anne (yes/no) X 3 Production Type (Descriptions, What-explanations, Why-explanations) Anova showed a significant interaction between Sally-Anne performance and Production type ($F_{(2,166)} = 3.93$; $p < 0.02$). Children who solved the false belief task gave more why-explanations than children who did not ($F_{(1,83)} = 11.29$; $p < 0.001$). A 2 Sally-Anne (yes/no) X Why-explanations with Vocabulary as covariate showed that the difference between the two groups is partially due to their lexical competence ($F_{(1,82)} = 4.55$; $p < 0.036$). These results show that false belief understanding plays a role in making children aware of the pragmatic contexts where explanations are required.

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Diurnal variations on language processing

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Human cognitive performance is greatly affected by time of day. Many researchers demonstrated this for a variety of performance measures in controlled chronobiological studies and in field studies (for a review, see Carrier and Monk, 2000).

Language processing, as a part of cognitive performance, is therefore assumed to vary over the day as well. In fact, there are evidences from several studies, which show qualitative differences in processing and producing language at different times of day (see i.e. Folkard 1982; Oakhill 1986, 1988; Dietrich 2006).

We examined in our field study the anaphoric resolution; it is well known, that syntactic, semantic and pragmatic factors are involved in processing this phenomenon. Therefore it seems a practicable tool for investigating language processing and its variations across the day. The German language makes use of two sets of pronominal elements, the personal pronoun (*er, sie, es*) and demonstrative pronoun (*der, die, das*). Both of them can naturally be used to refer to animate as well as inanimate antecedents. But they appear to have different preferences with respect to which antecedent is preferred. According to Bosch's *Complementarity Hypothesis*, personal pronouns have a slight preference for referents that are discourse topics, while demonstrative pronouns avoid those (Bosch et al. 2007). In a pilot study I was able to replicate the findings of Peter Bosch et al.

The same material was also used in our field study. We tested subjects working in rotating shifts at a hospital in Berlin. In each shift (early, late and night) three test sessions took place in a quiet room at their ward.

The results show significant variations in reaction time and accuracy between the early shift and the late and night shifts. But much more

interesting are the variations of the differences between the two conditions (demonstrative pronouns vs. personal pronouns as anaphors). These differences were significant in the evening and night, but not in the morning. We interpret these results as qualitative differences in language processing at different times of day. In fact, our results confirm the findings of Folkard and Oakhill. They argue, that "subjects may spontaneously place more reliance on maintenance processing in the morning, but more on elaborative processing in the evening" (Folkard 1979).

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Temporal idiomatic uses of spatial prepositions activate perceptual simulations in a first but not a second language

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Prepositions in natural languages often appear to be governed by arbitrary conventionalized idiomatic uses. For example, in English *"on"* refers to a specific date (e.g., *"She was born on May 24th"*), and yet *"in"* refers to a particular month (e.g., *"She was born in May"*). We present empirical evidence that idiomatic prepositional uses are not entirely arbitrary, as they activate image-schematic perceptual simulations during language processing.

In Experiment 1, fifty-one English native speakers were prompted to think about either the *date* or the *month* of their birthday, and then had to select one of four calendar diagrams (two foils, one flat calendar and one box-like calendar diagram designed to invoke perceptual simulations of support and containment respectively; Figure 1). There was a significant relationship ($\chi^2(1) = 23.73$, $p < .001$) between the date or month question prompt (implicitly eliciting *in* or *on*) and the type of calendar chosen (containment or support). Thus, spatial schemas can be spontaneously activated when thinking about time even for non-literal, idiomatic uses.

Prepositional uses are notoriously difficult for English L2 learners. We surmised that improper prepositional uses may be linked to improper underlying perceptual simulations. To test this hypothesis, in Experiment 2, 82 native Japanese-speaking students of English were presented the same task as Experiment 1. Here, results indicate no relation between the date or month question and calendar choice ($\chi^2(1) = 0.92$, $p = .34$). A generalized log-linear model fitted with three variables

(Native Language, Prompt Question, Calendar Diagram) yielded a significant three-way interaction, confirming that only the native speakers show a tendency to select calendar images consistent with the time question posed to them.

The experiments offer both theoretical and practical insights into how prepositions are processed by individuals with varying levels of language knowledge.
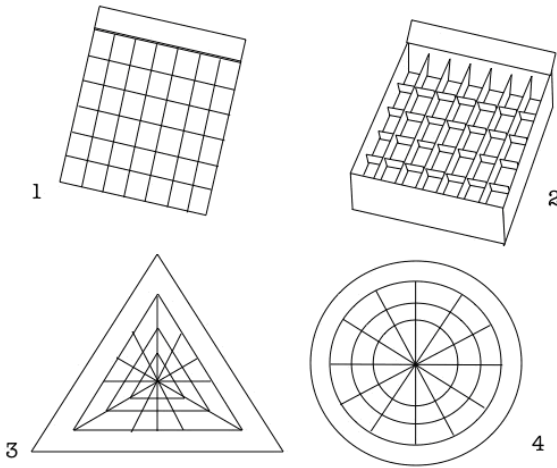
Figure 1: Calendar diagrams used in Experiments 1 and 2

The cognitive basis of lexical selection

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Speaking requires (among other things...) choices and decisions about the message to be expressed, the words to be uttered, and the grammatical rules to be upheld. My talk will address the organization of these choices. To do so, I will not focus on how linguistic information may be represented (e.g. format), but rather on the selection mechanism itself. In particular, I will show how general-purpose processes seem to be at work during lexical retrieval and monitoring. This idea will be illustrated with data from word or phrase production experiments (e.g. *"table"* or *"the green table"*) in mental chronometry, dual task and electrophysiology (EEG) paradigms.

WHEN PERSONS DISAGREE: AN ERP STUDY OF UNAGREEMENT IN SPANISH

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Agreement is one of the main devices used by languages to signal grammatical relations. Mainstream generative grammar conceives agreement as an asymmetrical relation, in which feature checking and interpretation are assumed to rigidly proceed from subject to verbal morphology. In this ERP study, we investigated the processing of subject-verb agreement in Spanish using Unagreement, a phenomenon in which an apparent person mismatch nonetheless produces a grammatical pattern, as in (1):

(1) Los periodistas   escribimos un articulo muy interesante
     The journalists$_{3.pl}$ wrote$_{1.pl}$ an article   very interesting

     We journalists wrote a very interesting article'

Here, a dependency is established between verbal and nominal Person that forces the 3rd person plural nominal to be interpreted as 1st person plural, arguably because of a reverse Agree operation at work. Unagreement was compared to well-formed sentences with full agreement (Control) and ill-formed sentences with Person Mismatch (*Los periodistas$_{3.pl}$ escribiste$_{2.sg}$ un articulo muy interesante* / The journalists$_{3.pl}$ wrote$_{2.sg}$ a very interesting article). Twenty-five participants read a total of 240 stimuli (experimental and filler sentences) and expressed an acceptability judgment at the end of each sentence.

Between 300-500ms, both Unagreement and Person Mismatch elicited a negativity whose maximum effect was in the left posterior areas, although in the second case the effect spreads also over central areas. Between 500-800ms, Unagreement generated a less positive effect in

centro-posterior areas, while the Person Mismatch elicited a P600 effect evident both in the posterior and anterior areas. Between 800-1000ms, no differences were found between Unagreement and Control, while the Person Mismatch produced a posteriorly-distributed P600.

The mechanisms operating in the comprehension of agreement may not be rigidly dependent on the asymmetrical relation assumed to exist between subject and verb, in terms of directionality of checking operations and interpretability of features. Unagreement may be initially parsed as ungrammatical, but the application of reverse Agree and the interpretation of Person on the verb may solve the conflict without triggering repair strategies. This seems to follow from the absence of differences between Unagreement and Control between 800-1000ms.

Testing Single Conjunct Agreement with Production Experiments

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Sentence production experiments with native Slovenian speakers show that linear order and conjunct number jointly influence Single Conjunct Agreement (SCA) with preverbal conjoined subjects (e.g. [*The pencils and the erasers*] *were missing.*). Particularly interesting is that on top of the prescriptive agreement in masculine plural (Herrity 2000), which we call default agreement, Slovenian exhibits two more strategies for agreement with a conjoined subject. Verbs can agree with a single conjunct, but can only target the highest (HCA) or the closest conjunct (CCA) (cf. Marušič, Nevins, & Saksida 2007). The three strategies appear to coexist and are in variation.

Our studies employ controlled elicited production: participants, all native speakers of Slovenian, read a sentence model on the screen (e.g., *The pen was missing.*) and are subsequently presented with the target subject noun phrases on the next screen. Their task is to produce a sentence based on the model sentence using the target subject (e.g. displayed: *the pencils and the erasers*; they produced: *The pencils and the erasers were missing*). We assess how speakers determine the agreement properties of conjoined noun phrases by systematically varying the gender and number of each conjunct. Produced sentences are recorded and the responses tabulated.

The resulting agreement patterns indicate that the distribution of default agreement vs. SCA is influenced by the grammatical number of the individual conjuncts. SCA is typically impossible when the conjunct at hand is explicitly singular: Singular agreement was rarely produced for both uniform- and mixed-gender combinations of uniformly singular conjuncts (e.g. *The pencil and the eraser*). The effects of

number are confirmed in cases of Mixed-number conjuncts. Neut.sg NPs conjoined with Fem.pl NPs in both orders (Neut.sg+Fem.pl / Fem.pl+Neut.sg) elicited only the default Masc.pl and Fem.pl agreement. This means, both HCA and CCA were available, but only with the plural conjunct.

Clear evidence that linear proximity and conjunct number-features each play a role in selecting the participle's agreement value also derives from the distinct influences of Neut.sg vs. NPs quantified with numerals 5 and up. Both lexical Neut.sg and these '5&Ups' trigger Neut.sg agreement, but unlike Neut.sg, 5&Ups are standardly assumed to lack explicit number and gender features. Neut.sg agreement on the verb comprised 61% of responses following conjoined [NPpl+5&Up] subjects; but only 10% following [NPpl + Neut.sg]. Avoidance of production of SCA with Neut.sg conjuncts shows that this derivation is blocked since the potential conjunct source is unequivocally marked as singular (in this case Neut.sg), due to conflict with the [-singular] feature borne by the conjoined subject as a whole. These results suggest that online language production involves access to hierarchical structure, linear proximity, and feature-specific computations.

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Marušič, F., Nevins, A., & Saksida, A. (2007). Last-conjunct agreement in Slovenian. In R. Compton et al (eds.), *Proceedings of FASL 15*. pp. 210-227. Ann Arbor: Michigan Slavic Publications.

Language-induced constraints on statistical learning: Implications for second language acquisition

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Infants and adults are remarkable 'statistical learners': they can rapidly extract structural properties of language-like stimuli from probabilistic information, and for this reason statistical learning (SL) abilities have been increasingly implicated in explaining language acquisition. In this study we contend that two tacit assumptions underlying SL research are misguided: first, that the most useful computations to detect structure are forward-looking (e.g., in the form of forward transitional probabilities), and second that these computations operate largely universally and invariably regardless of age and prior experience.

We investigated how both the predictive and retrodictive regularities that are most consistently observed in one's native language, such as word order, may constrain SL. In English, the head elements in a phrase come first, while in Korean the head follows the phrase (e.g., 'Door-OBJECT close-IMPERATIVE' = 'You close the door'). English is also mainly prepositional ('to school'), while Korean is postpositional ('school to'). This may generate different sets of expectancies for transitional probabilities (TPs): in English *forward—TP(school|to)* is much lower than *backward—TP(to|school)*, and vice-versa in Korean.

We exposed English and Korean adult speakers to a 5-minute pauseless sequence of synthesized syllables that a priori could have two equally possible and orthogonal parsings. Perception of grouping boundaries could emerge either when the forward transitional probability between adjacent syllables was high and the backward probability was low (Hi-Lo groupings), or viceversa (Lo-Hi groupings). At test, the two mutually exclusive groupings corresponding to patterns of Hi-Lo probability

or Lo-Hi probability were pitted one against the other in a forced-choice task.

An ANOVA indicated no main effects and a Language by Grouping interaction ($F_{(1,32)} = 18.96$, $p < .001$). English native speakers preferred the Lo-Hi groupings 66% of times ($p < .001$). Conversely, Korean native speakers preferred Hi-Lo groupings 64% of times ($p < .025$). A control group of participants exposed to the test phase only showed no grouping preference grouping ($p > 0.3$ for both language speakers).

These results can shed light on difficulties involved in learning a language later in life. Although our Korean participants were immersed in an English-speaking environment and had received extensive formal explicit training in English, under conditions of rapid online processing of speech they exhibited implicit statistical learning biases congruent with their native language. Becoming proficient in a second language may involve implicit mechanisms that 'retune' to the statistics of the L2.

Representation and Processing of Familiar Phrases in the Brain

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Previous research suggests that frequent multi-word sequences may be represented in the mental lexicon (Arnon & Snider, 2010; Bannard & Matthews, 2007). Such studies provide evidence for a processing advantage for frequent versus infrequent phrases. While such behavioural research is informative, it tells us little about the *mechanisms* involved in phrasal processing above and beyond the speed of processing.

In three ERP experiments, we investigate neural correlates underling the processing of familiar (compositional) phrases. Because the phrases in question are familiar, and hence predictable, two components may be implicated: the P300 and N400. The P300 has been found in highly constraining contexts, where lexical search may not be required, such as *The opposite of black is white* (Roehm et al., 2007). The N400 component is known to be modulated by frequency, general sentence predictability, and semantic integration.

In Experiment 1a, participants read frequent binomials (*knife and fork*), infrequent but strongly associated phrases (*spoon and fork*), and semantic violations (*theme and fork*). In Experiment 1b, participants read the same stimuli without "and" (*knife-fork/spoon-fork/theme-fork*). Experiment 2 investigated the processing of binomials, reversed forms, and semantic violations in a context (*He put his knife and fork / fork and knife / knife and gulf on the cloth and stared at the waiter*).

The N400 was observed for semantic violations across all experiments. Further, binomials elicited smaller N400s in Experiment 1a, suggesting a reduced processing load. This is in line with idiom research (Laurent et al., 2006; Strandburg et al., 1993; Vespignani et al., 2010). In addi-

tion, binomials elicited the P300 both in (Experiment 2) and out (Experiment 1a) of context. We attribute this finding to "template matching", wherein the target sequence activates a template that matches the upcoming information (Kok, 2001; Vespignani et al., 2010). Crucially, in Experiment 1b, where items were presented without "and", no differences were observed between binomials and associates. This finding implies that what drives the difference between binomials and associates in Experiment 1a is the *phrasal status* of binomials, which is why this difference disappears in Experiment 1b, where word sequences are no longer presented in their phrasal, and hence highly predictable, form.

These findings suggest that different neural correlates underlie the processing of familiar and novel language. Our findings are in line with the view, according to which frequent phrases are characterized by a reduced processing load. They provide further evidence in support of the lexicon that extends beyond the arbitrary forms, such as morphemes and words. Finally, our findings shed light on the nature of the P300; specifically, its engagement in the processing of linguistic stimuli characterized by high cloze probability.

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Kok, A. (2001). On the utility of P300 amplitude as a measure of processing capacity. Psychophysiology, 38, 557-577.

Laurent, J., Denhires, G., Passerieux, C., Iakimovac, G., & Hardy-Bayl, M. (2006). On understanding idiomatic language. *Brain Research*, 1068, 151-160.

Roehm, D., Bornkessel-Schlesewsky, I., Rsler, F., & Schlesewsky, M. (2007). To predict or not to predict: Influences of task and strategy on the processing of semantic relations. *Journal of Cognitive Neuroscience*, 19, 1259-1274.

Strandburg, R., Marsh, J., Brown, W., Asarnow, R., Guthrie, D., & Higa, J. (1993). Event-related potentials in high-functioning adult autistics. *Neuropsychologia*, 31, 413-434.

Vespignani, F., Canal, P., Molinaro, N., Fonda, S., & Cacciari, C. (2010). Predictive mechanisms in idiom comprehension. *Journal of Cognitive Neuroscience*, 22 (8), 1682-1700.

Collocational constraints in sentence comprehension: A tool for investigating predicitve mechanisms

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Despite the potentially infinite creativity of language, many words are patterned in ordered strings called collocations. Final words of these clusters are highly predictable; in addition, their overall meaning can vary on the literality dimension, ranging from (figurative) idiomatic strings to literal strings.

These structures thus offer a natural linguistic scenario to contrast processing correlates of contextual expectation and semantic integration during comprehension.

We focused on the ERP elicited by the last word of the collocation (Collocation condition; cloze-probability > 85%) compared to a replacing one with similar lexical properties (Substitution condition; no semantic violation). We implemented a 2 by 2 design crossing Substitution (Collocation vs. Substituion) and Literality (Literal vs. Figurative).

FIG   Ricardo y Rosa estuvieron en pie de <u>guerra</u>/!<u>combate</u> toda la semana.

     'Ricardo and Rosa were in foot of <u>war</u>/!<u>fight</u> (at loggerheads) all week.'

LIT   Él imaginò al personaje a su imagen y <u>semejanza</u>/!<u>similitud</u> cuando escribià la historia.

     'He imagined the character in his image and <u>similarity</u>/!<u>resemblance</u> (in his own image) when he wrote the story.'

Principal Component Analysis revealed two sources of variance in the 250-450 ms interval. In the 250-350 ms interval only a main effect of the Substitution emerged: a P300 was evident in the posterior

electrodes. In the following interval (N400) Substitution and Literality interacted: in the anterior electrodes the N400 was largely reduced for the literal collocations but not attenuated for the figurative.

Our results suggest that the P300 represents a template matching process: differently from the 'classical' posterior N400 effect that is sensitive to the cloze-probability, the P300 would represent a categorical predictive mechanism.

Conversely, the anteriorly boosted N400 effect for figurative strings replicates previous ERP findings on figurative meaning processing. This anterior modulation suggests the existence of a qualitative distinct brain network that handles with complex meanings stored in semantic memory that could not directly derive from literal semantic integrative mechanisms.

Cacciari, C., & Tabossi, P. (1988). The comprehension of idioms. *Journal of Memory and Language*, 27, 668-683.

Vespignani, F., Canal, P., Molinaro, N., Fonda, S., & Cacciari, C. (2010). Predictive mechanisms in idiom comprehension. *Journal of Cognitive Neuroscience*, 22 (8), 1682-1700.

Context-driven expectations in Idiom comprehension

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The sentence context is the main source of discourse-based expectancies that readers develop as text unfolds. To study how contextual information and upcoming words processing interact we used Italian ambiguous idiomatic expressions, embedded in sentences. The very same critical words preceded by qualitatively different contexts (literal vs idiomatic) were compared. The context should affect the way in which idiomatic expressions are processed: idiom's recognition might be anticipated and additional integrational efforts might be required when idioms are embedded in figurative context.

We thus recorded the Event Related Potentials that are a powerful research tool to study language comprehension, even if few studies on idioms adopted this methodology (Vespignani et al., 2010; Molinaro and Carreiras, 2010). Three conditions were designed: Idiomatic Condition (IC), Literal Condition (LC) and Control Condition (CC).

IC The politician was largely supported and even though involved in various scandals he was able to land on his feet (i.e., to succeed in difficult situations) in each mandate.

LC The rings require strength, agility and balance skills in order to land on your feet on the floor.

CC The shoes which she wore all day long were so tight that in the evening her feet were painful.

A Late Positive Component (LPC) was elicited by the last idiomatic constituent in IC in a relatively early time window (from 400 to 600 ms). The functional characterization of the LPC is far from clear in the literature, but it has been interpreted as reflecting conceptually demanding integration processes (Bornkessel, & Schlesewsky, 2008; Coulson, & Van Petten 2002) that in our study readers are required to make

when the unitary meaning of a multi-word expression needs to be integrated in the preceding context (in IC), operation that is not required when the expression is intended literally (in LC). Results are discussed within the Configuration Hypothesis framework (Cacciari & Tabossi, 1988) and provide compelling evidence for the crucial role of meaning integration processes in idioms comprehension.

Bornkessel-Schlesewsky, & Schlesewsky (2008). An alternative perspective on "semantic P600" effects in language comprehension. *Brain Research Review*, 59, 55-73.

Cacciari & Tabossi (1988). The comprehension of idioms. *Journal of Memory and Language*, 27, 668-683.

Coulson, & Van Petten (2002). Conceptual integration and metaphor: an event-related brain potential study. *Memory and Cognition*, 30, 958-968.

Molinaro & Carreiras, (2010). Electrophysiological evidence of interaction between contextual expectation and semantic integration during the processing of collocations. *Biological Psychology*, 83, 3, 176-190.

Vespignani, F., Canal, P., Molinaro, N., Fonda, S., & Cacciari, C. (2010). Predictive mechanisms in idiom comprehension. *Journal of Cognitive Neuroscience*, 22 (8), 1682-1700.

Truth as a constraint on semantic processing: hints from event-related potentials

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The seminal work by Tarski (1933), through subsequent developments, led to the idea of truth-in-a-model: the ways in which a sentence may turn out true can be formally described as models in which that sentence is interpreted. For example, consider (1) and (2).

(1) After the referee stopped the match, the boxer killed the opponent

(2) Before the boxer killed the opponent, the referee stopped the match

Here reference to truth is necessary to account for the fact that these sentences are not necessarily synonymous: both (1) and (2) are verified in a model (M') in which the boxer killed the opponent after the referee stopped the match, but only (2) is true in a model (M'') in which the referee's decision to stop the match prevented the boxer from killing the opponent. Truth-in-a-model has had a tremendous impact on logic and linguistics, but it has seldom been taken seriously in psycholinguistics and in cognitive neuroscience. Still, one can ask what are the relations between meaning and truth in language comprehension. One seemingly plausible answer is that truth values are computed on-line alongside phonological, syntactic and lexico-semantic representations of the input. If this is correct, 'before' sentences should be more difficult to process than their 'after' counterparts (Münte 1998), if anything because they require the reader to carry out certain inferences in order to choose between the two available readings M' and M''. Using

ERPs we indeed found stronger negative shifts for *'X before Y'* relative to *'Y after X'*, but also more negative responses to *'After X Y'* compared to *'Before Y X'*. Here one could argue that processing load is increased because truth-conditions for *'after'* sentences are too rigid to accommodate the preferred meaning. This would suggest that there are cases in which truth acts as a constraint on the on-line assembly of linguistic meanings, rather than as a separate level of semantic representation subject to incremental build-up.

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Do parasitic gaps exist (in Italian)?

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We show that the Italian structural equivalent of English parasitic gaps (PGs) (cf. in (1)) have properties that are not common to PGs as described in the literature (Culicover and Postal 2001). Two experiments address the following issues with off-line magnitude estimation measurements.

i. Italian PGs are sensitive to the transitivity of the verb contained in the adjunct PP, (2)a/a' vs. (2)b/b'.

ii. The d-linking effect (Quale-NP are predicted to be better than cosa-NP).

iii. The effect of perfective aspect in the adjunct clause is reversed in Italian PGs (perfective is supposed to improve PGs), (3)a vs. (3)b.

iv. Acceptability of PGs is evaluated against grammatical constructions, (2)c/c' and adjunct island violations, (4).

Experiment 1 addresses issues i. & ii. and part of iii. 12 strictly transitive and 12 optionally transitive (matched for frequency) verbs have been selected. 29 subjects participated to the experiment. The analyses show:

- An interaction of presence of PG by transitivity by type of clause $[F_{(2,56)} = 2.47, p < .1]$, resulting in the following rank: $(2)d' = (2)a' > (2)c' > (2)b = (2)b' = (2)c > (2)d$.

- No effect of d-linking in the PG condition $(2)b = (2)b'$ but $(2)c' > (2)b'$ (LDS adjustment).

Experiment 2 addresses issues ii. & iii. 18 subjects participated to the experiment. The analysis shows:

- An interaction of violation by aspect $[F_{(2,34)} = 27.61, p < .001]$: $(3)a > (3)b$, but $(4)b > (4)a$ (i.e. a reverse pattern emerged).

Conclusions: Italian PGs couldn't be assimilated to PGs in languages like English because they behave differently with respect to standard properties of PGs (Phillips, 2006):

- They are sensitive to transitivity inside adjunct PPs.

- Their status is intermediate with respect to extremes of acceptability.

- No d-linking effect emerges in PGs (contra Cinque, 1990).

- Perfective aspect has a reverse effect.

The pattern of Italian PGs can be interpreted as a parser's attempt to save the construction according to language specific options, e.g. by inserting pro in object position (Rizzi, 1986).

Examples:

(1) What did you cook ___ [PP without eating ___$_{PG}$]?

(2) a/a'. Cosa/ Quale piatto hai cucinato ___ senza mangiare (___$_{PG}$)?
      b/b'. Cosa/ Quale piatto hai cucinato ___ senza divorare (___$_{PG}$)?
      c/c'. Cosa / Quale piatto hai cucinato ___ senza divorarlo?
      d/d'. Gianni ha cucinato il pollo senza divorare/lo.

(3) a. Cosa hai preparato senza divorare ___$_{PG}$?
      b. Cosa hai preparato senza aver divorato ___$_{PG}$?

(4) a. Cosa sei andata in palestra senza divorare ___$_{island\,gap}$?
      b. Cosa sei andata in palestra senza aver divorato ___$_{island\,gap}$?

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Logic versus context in the processing and interpretation of scalar implicatures. A 'few' results.

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Scalar Implicatures (SIs) are inferences prompted by certain words, enriching an utterance's meaning (e.g. 'some' → 'but not all').
Recent studies (Breheny et al. 2006) show that SIs may be computed during the reading of a sentence, affecting reading times, if they are supported by context (*plausibility*). Panizza et al. (2009) also showed that the logical structure of the sentence (*polarity*) affects SI calculation and processing: upward entailing (UE) environments elicit more SIs than downward entailing (DE) ones.
We investigated the effects of polarity and plausibility on comprehension of the Italian word *pochi* ('few'). *Few* carries an implicature generating its existential meaning ('few' → 'but some'). If this implicature is blocked, *few* is interpreted with a non-existential meaning, compatible with *none*. We employed a novel paradigm in which subjects read sentences where *few* appeared in minimally different UE vs. DE constructions, which could push its interpretation towards an existential (1) or non-existential (2) reading (*plausibility*). After subjects read the first sentence (S1) they were presented with another sentence and a question (S2) they had to answer.
Results. Off-line judgments showed that subjects frequently interpreted *few* existentially in UE environments, regardless of plausibility (75 - 79% of 'yes' answers). In contrast, in DE environments they accepted the non-existential reading far more frequently in plausible conditions (73%) than implausible ones (36%).
On line data from S1 show that in UE conditions *few* elicited longer first-fixation times in implausible contexts (polarity by plausibility).

Polarity also affected the regression path duration of *few* (higher for UE conditions), suggesting that the implicature was computed in the first sentence. Instead, in DE conditions implausible items induced prolonged first pass reading times in S2 from the critical word (any) on, suggesting that here the implicature was computed later, only when forced by plausibility.

This findings lead us to rethink how logic and context interact in enhancing or delaying the processing of implicatures.

Examples:

(1) *Implausible items:*

S1-UE) Every fireman who risked his life because of the smoke put out **few** fires.

S1-DE) Every fireman risked his life because of the smoke if he put out **few** fires.

S2-UE) John, a fireman, risked his life because of the smoke. Did he put out **any** fire?

S2-DE) John, a fireman, didn't put out **any** fire. Did he risk his life because of the smoke?

(2) *Plausible items:*

S1-UE) Every director hired bad actors in his movies if he won **few** Oscars.

S1-DE) Every director who hired bad actors in his movies won **few** Oscars.

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Straight bananas: Shifting standards for Absolute Gradable Adjectives.

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Amongst the class of Gradable Adjectives (GAs, i.e. those adjectives that can enter into comparative constructions and be modified by degree expressions), a distinction is drawn (Kennedy & McNally, 2005) between relative (Rel, e.g. tall/short, big/small) and absolute (Abs, e.g. clean/dirty, full/empty) GAs. Rel-GAs need to be interpreted by making reference to contextual cues (eg. the intended class of comparison, 'tall for a gymnast'); Abs-GAs are context independent (*clean* means 'with no dirt on it', and not 'cleaner than a contextual standard'). Kennedy (2007) claims that (*i*) all GAs are measure functions that map individual onto degrees ordered along a scale; (*ii*) Rel-GAs project onto a totally open scale, thus the standard of comparison needs to be contextually retrieved; (*iii*) Abs-GAs evoke scales with at least one boundary, that constitutes the standard (min or max) against which the property is evaluated.

We conducted a first experiment and found that the interpretation of Abs-GAs needs not be context dependent. We presented 'abstract' objects in isolation and found that adults were more categorical with Abs than Rel ($p < .001$): yes-answers to 'This is bent' for a minimally bent 'abstract' rope were at ceiling; yes-answers to 'This is long' for a 17.5 cm-long 'abstract' rod (for which no class of comparison was inferable) were at chance. In an ongoing study we're addressing a second question: can contextual cues shift the std for Abs-GAs? Preliminary results indicate that when 'real life' objects are used for Abs-GAs, adults are less categorical: a minimally 'bent' banana can count as straight. Interestingly, *full* shows an even more 'shiftable' std. when applied to a glass of red wine, usually filled halfway. These preliminary results cast some doubts on Kennedy's hypothesis. We suggest that,

even if some cases could be accounted for by appealing to a pragmatic halo (judging a banana as *straight* is literally false, but pragmatically acceptable), the interpretation of *full* clashes with the hypothesis that *full* is a max std GA. One possibility is that *full* behaves differently from other Abs-Gas because the antonyms full/empty are not complementary; another possibility is that the semantics for Rel- and Abs-GAs is the same: in the absence of contextual clues, Rel cannot be interpreted while Abs are interpreted w.r.t. their 'intrinsic' std; in the presence of a banana, *straight* might not mean 'absolutely straight' but be interpreted as 'straight for a banana', as it happens for Rel.

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Mechanisms of agreement

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IKERBASQUE. Basque Foundation for Science.

Agreement plays an important role in language comprehension especially in richly inflected languages such as Spanish. Person, number and gender, which can be a conceptual or formal property, are features for agreement. In this talk I will describe behavioral and neuroimaging evidence on the agreement processes in language comprehension with different features mainly in monolinguals, but also in late learners of Spanish that do not have formal gender in their L1. The main addressed questions are a) how the processor solves agreement on-line when semantic or morphosyntactic features are available or absent; b) is agreement computed similarly for all features; c) do second language learners compute agreement as in their first language; d) what agreement tell us about mechanisms for sentence processing.

Input and generalization in first and second language acquisition

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In this talk, we combine insights and methods from linguistics and psycholinguistics to address fundamental questions in the cognitive science of language. We focus on sentence level generalizations in first and second language learners and use different tasks to examine the role of input frequency and lexical vs. abstract knowledge in child and adult acquisition. To address these questions, we report experimental studies that look at the acquisition of low frequency structures (passives) and complex sentence structures that are know to elicit errors in both first and second language acquisition (main and embedded questions).

In the first part of the talk, we use syntactic priming in language production to examine the sentence level representations of young three-year-old monolingual English speakers and show that children primed with passives produced significantly more passives in describing pictures with inanimate participants than did children primed with actives. The priming was genuinely abstract: the materials contained different lexical noun phrases, and verbs, and criteria for counting passives were strict. The results thus argue that young monolingual English children have more abstract sentence level representations than suggested by lexicalist accounts of language acquisition. We then report preliminary data from bilingual children Chinese/English children (ages 5-6), as part of an ongoing extension of our priming paradigm to examine sentence level representations in atypical learners (bilinguals and children with language impairments). The results from our bilingual group will shed light on to the interaction between the amount of prior language experience with low frequency structures and children's developing representations.

In the second part of the talk, we use elicited production and magnitude

estimation to examine the extent of rule generalization in the acquisition of English main and embedded questions. By comparing advanced adult learners of English with different first language backgrounds, we tease apart the effect of language transfer from more general learning biases in acquisition, while by comparing adult and child learners we focus on the influence of age of acquisition on syntactic development.

Our general approach demonstrates how it is possible to integrate theoretical approaches to language with experimental and potential clinical applications, and calls for studies of language representation and processing that take a dynamic comparative approach to the study of language throughout the lifespan.

Knowledge and processing of auxiliaries in a second language: Eye movements of tutored learners of Italian

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Research questions & hypothesis: Auxiliary selection is a diagnostic for the unergative/unaccusative distinction in Italian. Are learners of Italian sensitive to split intransitivity? (Sorace 2000; Oshita, 2001). The research question is twofold: (a) Can learners recognize only the auxiliaries of verbs they have already heard or do they apply an inferred rule also to novels? (b) Do they make use of a rule in on-line processing? If answer to (b) is yes, there might be two kinds of knowledge of auxiliaries following one another in a developmentally moderated fashion (Tanner, 2010), *rote*-learning preceding *rule*-learning (Mitchell et al., 1998).

Subjects:

Group	n.	Months of in Italy	L1	Hours of Instruction	Recency Instruction	Aux in L1
A	4	3-18	Germ, Pol Rum, Cro	30-80	+3	Yes
B	9	26	Chinese	650-1000	-20	No
C	12	2	Chinese	250-650	+3	No
Control	7	-	Italian	-	-	Yes

Method: Subjects rate (yes/no) 36 sentences with right and wrong auxiliaries. Measures: total RT, RT on critical zone, first pass, regressions (Staub and Rayner, 2007). Sentence display *type verbs* (unaccusative vs. unergative, core vs. peripheral) and *notype verbs* (double auxiliary and semantically mismatching verbs). Descriptive variables: L1, length / recency of instruction, time in Italy. Additional variables: token frequency of auxiliary + Past Participle constructions.

Predictions: **(A)** L2 processing is principle-based: **(i)** if syntax or semantics drive processing, violations result in an increase of RT measures; type and notype pattern differently; **(ii)** if frequency drives processing, illegal auxiliaries of more frequent verbs disrupt RT, whereas type and notype verbs

pattern similarly **(B)** L2 processing is constraint-based: **(iii)** L1 is a strong predictor for performance; **(iv)** no correlation between fixations over critical zone and performance; **(v)** no significant regressions over critical zones.

Results: (i) TRT reduce in the presence of violations (except for unaccusative core verbs in controls). First pass increase with illegal aux only in group A. No significant difference between verb types ($p > .05$); **(ii)** legal auxiliaries of more frequent verbs are read faster by controls and A subjects. Illegal aux of frequent verbs are read more slowly (Chinese learners pattern differently); **(iii)** group A shows better performance than Chinese learners in acceptability judgments (63% vs. 55%), but the only predictor for performance is frequency ($p < 0.001$). Verb semantics is a predictor only for controls (misclassification score = 0.33). **(iv)** auxiliaries are not skipped; fixation times correlate with learners' target like judgments (average r = 0.75); **(v)** less recent Chinese learners make more regressions on critical zone. Discussion. Subjects do not skip auxiliaries, they do not get gist of the sentence to spot the error. The more they look at the critical zone, the higher their chances to perform in a target-like fashion are. They react to unexpected colligations (in high transitional probability contexts) rather than analyzing unaccusative/unergative syntax or semantics. Either local processing (O'Grady, 2008) or shallow processing (Clahsen and Felser, 2006) are better accounts than rule-driven parsing for learners of this sample.

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Representation and Processing of Agreement in an Artificial Grammar Learning Paradigm: The Role of Semantics

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In natural languages, words are combined into constituents that entertain relations of syntactic dependency within a hierarchical structure (Chomsky, 1957). Agreement is considered to be a prototype example of structure-dependency. The subject and the verb are linked by virtue of their hierarchical position in the sentence, independently of their linear position in the word string (e.g., in a sentence as *"The daughter of the neighbours is pretty"* the verb does not agree with the nearest noun *neighbours* but with the subject of the sentence, i.e., *the daughter*). Although we have no difficulty in tracking this kind of dependency when we produce or understand natural language, several studies have provided contradictory results concerning whether and how the human mind is able to track non-adjacent dependencies in artificial languages (e.g., Perruchet et al., 2004; Newport & Aslin, 2004).

In order to investigate whether French participants are able to track structure-dependent non-adjacent relationships, we implemented Subject-Verb agreement in an artificial grammar. Crucially in this grammar, agreement, implemented by phonological markers, does not depend on the linear position of the words but on their hierarchical position in constituent structure, implemented by prosody. Participants were presented with sentences varying in length (2-4 words) and in hierarchical structure. In the first experiment, we trained the participants on auditory grammatical sentences, whereas in the second experiment, we added semantics to the grammar by training them on sentences that were accompanied by videos of geometric shapes performing the corresponding actions. Participants were then asked to perform a grammaticality judgement task involving generalizations to new lexical items and to new syntactic structures. Whereas no learning was observed when semantics was not included, results demonstrate significant learning of the structural dependency when the grammar was enriched with semantics. This is

one of the first studies in which the learning of a structural dependency is observed and is shown to be facilitated by the presence of semantics. The results will be discussed in reference to the debate on the learnability of nonadjacent dependencies in artificial grammars.

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STUDIES ON LANGUAGE ATTRITION: PHRASEOLOGY, A PARTICULAR LINGUISTIC FIELD.

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This study investigates the (non-pathological) loss of phraseologisms, such as fixed expressions, idioms and proverbs in late bilingual Italian emigrants living in Germany. Research on language attrition claims that the lexicon is the first linguistic area to be affected by attrition (Köpke & Schimd, 2004). This is so because: 1) numerically, lexicon is a much larger system than other linguistic areas, 2) lexicon is an open area where its components are more susceptible to change or adaptation than, for example, morphology or phonetics. In addition, 3) lexicon is stored in a different memory system (declarative memory) than grammar (procedural memory) (Paradis, 2009; Ullman 2006).

Phraseology is a particular linguistic field (Granger & Paquot 2008) which is composed of lexical items. Thus, it could be predicted that, like lexicon, phraseology can easily be lost due to a prolonged period of stay in the host country.

However, compared to simple words, some kinds of phraseology generally involve metaphors, metonymies, hyperboles or other kinds of figurations which make them easier to remember because they are concrete concepts (Danesi, 2001). For example, the expression *essere di manica larga* uses a concrete image ('the large sleeve') to convey an abstract concept ('to be indulgent').

Moreover, proverbs and idioms have an important social usage and they represent the perception of a linguistic community and its way to see the world (Burger, 1998).

Hence, for all the aforementioned reasons, my purpose is to demonstrate that some phraseologisms are potentially less susceptible to attrition than simple lexical words.

A questionnaire based on psycholinguistic principles, with a total of 65 questions, aiming to examine seven different types of phraseology was developed. The questionnaire was submitted to a control group (18 native speakers without influences of foreign languages) and 9 Italians who have been living in

Germany for at least ten years. The latter group was divided in two other groups: 3 Italians who emigrated before they were 12 years of age but after the 'sensible period' (Köpke, 2004), and 6 Italians who emigrated after their 12th year. All participants were asked to perform a judgment task, and to assess whether the given phraseology sounded 'Italian' or not, and to choose the 'most Italian sentence' among accepted Italian phraseologisms (*si ha l'imbarazzo della scelta*), translated German phraseologisms (incrocio i pollici per te from 'ich drücke dir die Daumen'), or partially modified Italian phraseologisms (*sano e vegeto come un pesce*).

The results of this study indicate two findings: the first is that the latter group do not undergo attrition in the analyzed phraseologisms, performing almost like the control group. The second is consistent with other studies of LA (Kaufman, 2001) which claim that age is one of the most important factors in triggering attrition.

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The spatial and temporal aspects of class categories: A MEG study of Noun and Verb Homophones.

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Lesion evidence and neuroimaging findings posit that nouns and verbs have distinct neural representations. In this study, the time course and cortical basis of noun and verb processing in the brain were studied using magnetoencephalography (MEG). Homophonous nouns and verbs in two-word phrases were visually presented in a silent reading task. Homophones were selected because they share the same word form but belong to different grammatical categories. A total of twelve healthy participants were tested and their spatiotemporal information was measured during the processing of the homophones.

The temporal processing of the NPs and VPs exhibited the components determined by studies of lexical processing using electrophysiological measures (Pylkannen et al, 2003; Xiang et al, 2009). The two grammatical categories displayed a response during 150-200ms (M170) which is indicative of letter string processing. Pre-lexical processing was evident during 200-300ms (M250) and advanced to the activation of the mental lexicon during 300-420ms (M350). Additionally NPs, as compared to VPs, showed a temporal delay at the late "cognitive" component of the function word and of the homophonous word. The temporal patterns of the function word (i.e., the article for NP; the pronoun for VP) differed for nouns and verbs, signifying a functional distinction in processing. This statistically significant difference ($p < 0.05$) occurred at the late "cognitive" component (275 ms) and revealed a strong dipolar source for the articles at the left front-temporal lobe. Further topographic differences in the early (464 ms) and the late "cognitive" component (617 ms) between nouns and verbs were depicted supporting the anatomically distinct representations of these class categories. The cortical areas implicated with the processing of verbs, as compared to nouns, during these two components were more focal to the front-central area.

The topographies of nouns and verbs diverge during pre-lexical processing and during lexical activation. Moreover, function words in NPs and VPs (articles and pronouns) operate on a different temporal course and utilize different spatial neuronal networks. These findings support the proposed distinction of the representations of class categories and suggest the differential processing of nouns and verbs and of their respective morphosyntactic operations.

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Neighbourhood size and neighbourhood frequency effects in recognizing Italian written words

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Introduction. The present research investigates neighbourhood size and neighbourhood frequency effects in recognition of Italian written words. Neighbourhood size is the number of words that may be generated by changing one letter of the target word, preserving letter positions; neighbourhood frequency refers to the relationship between the frequencies of neighbours and the frequency of the stimulus word (Grainger, O'Regan, Jacobs & Segui, 1989).

By extending the studies on Italian non words of Arduino & Burani (2004) and Mulatti, Peressotti & Job (2007) to Italian five-letter words, two experiments were carried out in order to test the neighbourhood size and the neighbourhood frequency effects, as well as the possible interaction between them.

Method. A 2 x 3 factorial design was employed, where the two factors were neighbourhood size (large/small) and neighbourhood frequency (no higher frequency neighbour/one higher frequency neighbour/more than one higher frequency neighbour). The three categories of small neighbourhood and those of high neighbourhood were balanced for the frequency of word forms by using the data provided by COLFIS (Bertinetto et al., 2005). In the first experiment, we employed a word naming task: participants had to read aloud a series of words balanced for initial phoneme and syllabic structure. So we had 12 groups of words like e.g.: *bonzo* (small neighourhood/no higher frequency neighbour), *borgo* (small neighbourhood/one higher frequency neighbour), *belva* (small neighbourhood/more than one higher frequency neighbour), *bimbo* (high neighourhood/no higher frequency neighbour), *barba* (high neighbourhood/one higher frequency neighbour) and *bando* (high neighbourhood/more than one higher frequency neighbour). In the second experiment, we employed a simple lexical decision task by adding an

equal number of non words to the same list.

Results and Discussion. The results of the first experiment showed a facilitatory neighbourhood size effect, with shorter reaction times on words having a large neighbourhood, and a facilitatory neighbourhood frequency effect only in the small neighbourhood condition, with shorter reaction times on words having few neighbours and at least one higher frequency neighbour. The results of the second experiment showed a facilitatory neighbourhood size effect for words and an inhibitory neighbourhood size effect for non words. Contrary to the naming task, in lexical decision we found an inhibitory frequency neighbourhood effect only in the large neighbourhood condition both for words and non words, with slower reaction times on stimuli having a large neighbourhood and at least one higher frequency neighbour.

Our results are partially compatible with those found by Arduino & Burani who detected a significant inhibitory effect of neighbourhood frequency for non words in the lexical decision task, but no effect of neighbourhood size. Furthermore, the results support the multiple read-out model (Grainger & Jacobs, 1996), which predicts and simulates reaction times to both words and non words through the total activation of the lexicon: the total activation of the orthographic input is correlated with the number of its neighbours and with their frequencies.

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Nominalization in aphasia: a case study

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Background and Case History

Deverbal nominals are defined as nouns displaying some verbal properties. All the accounts (e.g. Alexiadou & Grimshaw 2008) agree in that nominals are not a homogeneous class: complex event-nominals (e.g. 'examination') have thematic roles and no plural reading whereas result-nominals (e.g. 'offer') show the opposite pattern.

In order to test if nominals involve verbal properties, unlike simple nouns, and are not a homogeneous class, an experimental study has been conducted involving an Italian 76-year-old right-handed aphasic patient (ED). ED suffered a CVA involving the left frontal lobe. He was administered the AAT and classified as mild Broca's aphasic; the BADA revealed a noun-verb dissociation.

Methods and Tasks

The screening test highlighted a spared syntax of nouns, but problems with the syntax of verbs. ED performed badly with the passives (16,6%) and the unaccusatives (50%) compared to the transitives (100%) and the inergatives (100%), showing an argument structure complexity effect (e.g. Thompson 2003).

In a second test ED had to derive the nominal starting from a neutral verb form in a sentence contest. ED's production was tested of: (i) nominals with thematic roles ('la camminata') vs. nominals without thematic roles ('il cammino'); (ii) participial nominals ('la scoperta') vs. derived nominals ('l'invenzione'); (iii) nominals + PP argument ('la raccolta di grano') vs. *infinito sostantivato* + direct argument ('il raccogliere giochi'); (iv) singular nominals ('la promessa') vs. plural nominals ('le promesse').

Each group was made up of nominals derived from transitive, inergative and unaccusative verbs.

Results

Unexpected results: no argument structure complexity effect; complex event-nominals [+ thematic roles] (50%) better than result-nominals [- thematic

roles] (20%); participial nominals (80%) better than derived nominals (30%). Expected results: nominals involving noun syntax (50%) better than nominals involving verb syntax (0%); singular participial nominals (80%) better than plural participial nominals (10%) (a confirmation that complex event-nominals cannot have a plural reading).

These results confirm the hypothesis that deverbal nominals are not a homogeneous class. ED found it easier to derive nominals associated with an argument structure from a verb stem because they are verbal in nature. ED's poor performance with nominals without argument structure seems to suggest that argument structure is really a property of verbs but it is not the crucial property that affects ED's ability to produce verbs. Thus, this study confirms only partially Collina, Marangolo & Tabossi's (2001) findings.

Pragmatics and Morphosyntax in Italian SLI Children.

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The failure to produce clitics is a clinical marker of SLI in Italian preschool children. The most persistent error type is omission (Bortolini et al., 2006). It is not known whether this failure and error type persist during school years. Besides morphosyntactic competence, the production of clitics involves pragmatic abilities since they usually denote a discourse topic. The comprehension of quantifiers might also require pragmatic competence, besides semantic awareness, when an implicature must be drawn. In fact, the sentence "some apples are in the basket" is logically true but pragmatically underinformative in a context where all the apples are in the basket.

We tested 10 Italian speaking SLI children (age range 6;4-8;7, M=89months), 10 age matched controls (6;2-8;4, M=88months) and 10 language matched controls (5;2-6;10, M=90months) in the production of direct object clitics and in the comprehension of quantified sentences (Katsos, in press).

Statistical analysis revealed that SLI children produced less clitics than age controls ($\chi^2(1) = 5.04$, $p = 0.02$) and language controls ($\chi^2(1) = 4.27$, $p = 0.03$). In most cases, when they did not produce a clitic, they produced the corresponding NP, unlike the age controls ($\chi^2(1) = 4.48$, $p = 0.03$) and language controls ($\chi^2(1) = 3.47$, $p = 0.06$). The comprehension of quantified sentences was poorer in SLI children than in age matched controls, $\chi^2(1) = 4.58$, $p = 0.03$, with no difference from language matched controls: they had problems with sentences involving the computation of an implicature.

Our results show that:

1. SLI children still display problems with clitics during school years;

2. the prevalent error at this age is the use of a full NP rather than argument omission: they know that an argument must be expressed but they are unable to express it with a clitic pronoun. We argue that clitic omissions depend on the morphosyntactic complexity of clitic climbing

operations rather then on a pragmatical failure in understanding the clitic function;

3. SLI children are poorer than age peers in understanding quantified sentences when an implicature must be drawn. This suggests that SLI may affect not only morphosyntax, but also pragmatic aspects of the linguistic competence, although to different degrees.

Bortolini, U, et al. (2006) clinical markers for specific language impairment in Italian: the contribution of clitics and non-word repetition. *International Journal of Language and Communication disorders*, 41, 695-712.

Katsos, N. (in press) *Evaluation underinformative utterances with context dependent and context-independent scales.* In Sauerland, U. & K. Yatsushiro, Experimental semantics and pragmatics, Palgrave.

Language Specific Effects in Alzheimer's Disease : Subject Omission in Italian and English

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In this talk we take a cross-linguistic approach to examine the following questions: How does a native speaker's knowledge of her language's syntax interact with processing factors such as sentence length and complexity? Conversely, how do general cognitive constraints interact with the grammatical properties of individual languages?
We explore these questions by focusing on the linguistic parameter that licenses null subjects in languages like Italian and prohibits them in languages like English (Chomsky, 1981). The contrast between these two types of languages is illustrated in (1). Without an overt third person subject (e.g., *she*), the English sentence in 1a is ungrammatical, whereas the corresponding Italian sentence is fully grammatical. Languages like Italian are often referred to as null subject languages. In these languages the null subject is pro (pronounced "little pro") and is assumed to be a phonologically silent, but syntactically present, element with pronominal properties.

(1)   a. * Walks on the beach

         b. Cammina sulla spiaggia

We used a repetition task to examine the effect of sentence complexity on the production of syntactic subjects by English and Italian speakers with Alzheimer's Disease (AD). By using the same task and matched materials with speakers of languages that contrast minimally on a grammatical property (i.e., obligatoriness of overt subjects), we can tease apart the effects that are due to general repetition ability and those that result from language-specific syntactic properties.

In Experiment 1, twelve Italian speakers with AD and twelve age and education-matched controls repeated sentences of varying length. As predicted, Italian AD speakers omitted sentence subjects in complex sentences while control participants very rarely did. In Experiment 2, ten English AD speakers, matched with the Italian AD participants with respect to age and severity of the disease, and ten age and education-matched controls repeated translation equivalent-materials. Unlike the Italian AD participants, English AD participants did not omit sentence subjects. Italian and English AD participants, however, were comparable in their overall ability to repeat sentences of varying length. These results indicate that the performance of AD speakers in repeating sentences interacts with language specific properties. We are following up on these studies with a Rapid Serial Visual Presentation (RSVP) paradigm of the same materials with healthy English-speaking adults, and plan to extend this work to Italian, to see whether a similar pattern can be induced in healthy subjects once processing resources are taxed.

"The dog that the boy is looking is chasing the cat". Do we need the phonological loop to understand it?

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The specific role of phonological loop (PL) in sentence comprehension is still a matter of debate. It has recently been suggested (Caplan & Waters, 1999) that PL plays a role only in a post-interpretative stage, whereas a separate subsystem within working memory, specific for language, is responsible for the syntactic and semantic operations performed online when a sentence is interpreted. Support to this claim is provided by neuropsychological data showing no major impairments in language comprehension of PL patients (Waters & Caplan, 1996; Martin, 1987; Vallar & Baddeley, 1984). However, when syntactically more complex sentences are accounted for, both behavioural (Waters et al., 2003) and neuropsychological data (Caramazza et al, 1981; Friedrich et al, 1984; Papagno et al., 2007) suggest that PL needs to be consulted for their comprehension.

In this study we tested the behavioural consequences of disruption of activity in left BA 40 and BA 44, key regions of PL, on language comprehension using 1 Hz rTMS. Comprehension was assessed by means of two tasks: a sentence-to-picture matching task (Experiment 1) with sentences of with sentences varying in length and syntactic complexity and a sentence verification task (Experiment 2).

In Experiment 1 rTMS over both left BA40 and left BA44 significantly reduced accuracy for syntactically complex sentences. Moreover only rTMS over left BA 40 disrupted comprehension of sentences long but syntactically simple.

In experiment 2 rTMS over left BA40 impaired comprehension of long sentence in which word order was crucial.

We suggest that the neural correlates of PL, left BA40 and left BA44, are both involved in the comprehension of syntactically complex sentences, while only left BA40, corresponding to the short-term store, is recruited for the comprehension of long but syntactically simple sentences and sentences in which word order is crucial.

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