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Talks

Visual attention and novel word learning: New evidence from first- and second-language learners of Brazilian Portuguese and English

Rui Rothe-Neves, Nadia Lana, Marina Leite and Beatriz Carvalho

An ongoing debate in language learning research centers on whether the visual attention given to new words impacts how well readers learn their form and meaning (Elgort et al., 2024). The Noticing hypothesis (Schmidt, 1990) posits that greater visual attention to a novel word leads to better learning. Our study is the first to investigate novel word learning within participants for L1 and L2, and between participants for L1. We explored this by analyzing eye movements during novel word learning and subsequent vocabulary test performance. We tested Brazilian Portuguese speakers (n=35, nine male, M age = 21.77) using an incidental word learning paradigm, where they read texts containing novel Portuguese and English words with concrete, neutral meanings. Canadian English speakers (n=40, four male, M age = 20.32) were also tested in their L1. Eye movements were recorded as a measure of attention. Results showed that reading times decreased with each exposure for all groups. However, Brazilian learners did not show a further speed-up after four exposures in either L1 or L2. Canadian readers were generally faster than Brazilian readers, potentially indicating environmental differences. After five exposures, L1 readers (Brazilian Portuguese and Canadian English) achieved similarly short total fixation times and gaze durations, while L2 reading (Brazilian English) remained longer. Crucially, for Brazilians reading in English, increased total fixation time at first exposure positively correlated with better performance in both meaning recall and recognition tasks in English, explaining roughly 20% of the variance. These findings highlight the significant role of visual attention in novel word learning, warranting further investigation.

Keywords: Word learning, Eye tracking, Vocabulary acquisition, Second Language

Unpacking Predictive Processing in a Third Language (L3): Eye-Tracking Evidence from "Test-Tube Languages"

Carla Menares Arancibia, Eloi Puig Mayenco and Jill Hohenstein

Although extensive research has explored L3 acquisition in acceptability tasks, less attention has been given to real-time mechanisms, such as prediction, to understand cross-linguistic influence during L3 processing. While L2 predictive processing is influenced by L1 characteristics and language experience (e.g., Morales et al., 2016; Valdés Kroff et al., 2017; Hopp & Lemmerth, 2018; Baron et al., 2022), the impact of prior languages on L3 prediction remains unexplored. This ongoing visual world paradigm (VWP) study investigates (a) whether bilinguals can use gender-marked prenominal cues to predict nouns in an artificial language (AL) after minimal exposure, and (b) the role of structural similarity, lexical congruency, and immersion in an English-dominant environment. Three bilingual groups in England were trained in one of two ALs (modified forms of Polish or Chilean Spanish) which differ in gender categories and prenominal gender cues. The groups included Chilean Spanish-English bilinguals learning Artificial-Polish, Polish-English bilinguals learning Artificial-Spanish, and a control group of Chinese-English bilinguals (with no L1 grammatical gender). After two training sessions, participants completed a VWP experiment where prenominal gender cues (informative vs. uninformative) and noun gender congruency were manipulated. A week later, a delayed VWP task was conducted. Both L1-Spanish and L1-Polish groups completed an L1 VWP task. Preliminary growth curve analyses of the Artificial-Polish VWP experiment show higher fixation proportions in the informative condition for both Spanish-English and Chinese-English groups. Gender congruency facilitated processing for Spanish speakers, particularly in the informative condition, and similar patterns were observed in the delayed task. These findings suggest bilinguals can use L3 gender cues to predict upcoming nouns after limited exposure, despite differences in gender categories across L1 and L3. Results are discussed in relation to current L3 models and the implications of using artificial languages to investigate L3 processing (Grey, 2023; González Alonso et al., 2025).

Keywords: L3 processing grammatical gender, eye-tracking, predictive processing, artificial languages

The Effect of Language Dominance on Relative Clause Processing: a VWP study

Leeann Stover and Gita Martohardjono

This study investigates the well-known Subject over Object (S/O) advantage in relative clause processing and comprehension. We focus on Spanish/English bilinguals with varying language dominance using eye-tracking with a VWP design. We hypothesized that relative Spanish/English dominance would modulate the S/O asymmetry, such that increased Spanish dominance would 1) lead to increased evidence of the asymmetry in gaze data measures, with significantly higher fixation proportions on the target image during SRC compared to ORC, and 2) on behavioral measures of comprehension accuracy and response time. Participants were 59 Spanish/English bilingual adults with varying ages of arrival to the US, where Spanish is a societal minority language. Participants listened to sentences while looking at an array of three images selecting the correct image with a mouse click. Gaze data was recorded in two ROIs: relative (RC) and matrix (MC) clause regions along with accuracy and RT (see sample images below). Gaze data showed that higher Spanish dominance led to a larger processing asymmetry in both the RC and MC regions. However, rather than a facilitatory effect in subject relatives, this asymmetry was primarily driven by a late negative effect in object relative constructions. To account for these results we propose that increased dominance in the first-learned language leads to more active online syntactic structure building, resulting in higher integration cost when an expected parse fails. Accuracy results only showed sentence type (SRC) as significant predictor of the subject advantage. Finally, both sentence type and language dominance had significant effects on log-transformed RTs: longer for ORC than SRCs. By pinpointing the locus and nature of the asymmetry our study demonstrates that eye-tracking is a more sensitive measure than accuracy, especially for highly proficient bilinguals.

keywords: Relative Clause Processing, Spanish/English Bilinguals, VWP

The Impact of Expert Jargon on Trust and Recommendation Adherence: Insights from a Gamified Eye-Tracking Experiment

Michelle Danhier and Renate Delucchi

Trust is essential for social cohesion but remains low in Latin America, undermining social integration and development. Although expert jargon signalises professional identity, it can alienate lay audiences. We hypothesize that technical language reduces trust and adherence to expert recommendations. Unlike prior research relying on self-reports, our study examines actual behavior and eye-tracking data in realistic decision-making contexts. We conducted a gamified eye-tracking experiment with 20 Spanish-speaking participants to investigate how expert jargon affects recommendation adherence. The experiment was piloted (N = 15) to test decision-making scenarios and adapt trust-related scales from English. In the eye-tracking experiment, participants navigated interactive narratives inspired by point-and-click adventures and RPGs. In these high-ecological-validity tasks, experts-NPC used either domain-specific jargon or plain language. Visual layout, word count, and content were controlled and scenarios randomized across conditions. Trust was measured behaviorally by whether participants followed expert recommendations. To precisely capture subjective judgements and cognitive processing patterns, we employed a within-subjects design, with both conditions administered to participants two weeks apart. This approach provides a natural anchor, minimizes noise and individual differences and boosts statistical power. A post-task questionnaire collected individual trust propensity and demographics. Eye-tracking data revealed significantly more regressions and fixations on jargon versus equivalent plain terms across five critical scenarios. A mixed-effects model showed that trust propensity moderated this effect; age and gender had smaller roles, and in-group bias was not significant. Overall, expert jargon reduced trust and adherence, especially in high-stakes, vulnerable situations. Our results support Cognitive Fluency Theory, showing that difficult-to-process language reduces perceived trustworthiness, not by diminishing perceived expertise, but by undermining transparency. By moving beyond self-reports to observe actual behavior, this study highlights trust as a situational and dynamic construct and provides empirical evidence on how language shapes trust in expert-layperson interactions, contributing to both linguistic and marketing research.

Keywords: Expert language, eye-tracking, trust, trustworthiness, gamification, linguistics marketing

Cognitive Compensation in Reading: Eye-Tracking Bridging Inferences in Aging Adults

Ernesto Guerra, Andrea Helo, Carlos Rojas and Bernardo Riffo

As populations globally continue to age, comprehending how older adults maintain effective reading abilities is increasingly relevant. A critical aspect of reading comprehension involves integrating current linguistic input with previously read information, primarily through bridging inferences. While the cognitive costs associated with making such inferences have been established in younger readers, distinctions in inference processing between third-age (60-79 years) and fourth-age (80+ years) adults remain understudied. Understanding these distinctions can elucidate the compensatory strategies older adults employ for successful comprehension despite cognitive and processing declines. This study employed eye-tracking to explore how 150 monolingual Spanish-speaking older adults (86 third-age, 64 fourth-age) managed online word-to-text integration. Participants read two-sentence passages designed to elicit bridging inferences or simple repetitions, with eye movements captured using an EyeLink 1000 system. Reading comprehension was occasionally assessed through true/false probes. Critical word regions were analyzed using three eye-tracking measures: first-pass reading time, regression-path duration, and total reading time. Our findings demonstrated notable age-group differences in inference processing. Specifically, third-age readers displayed immediate inference-related slowing across all eye-tracking measures. In contrast, fourth-age readers did not show initial delays in first-pass reading times but exhibited pronounced inference costs later, primarily reflected in extended total reading times. Although fourth-age readers' total reading durations were generally longer, the proportional inference cost was comparable across both groups. These outcomes suggest a delayed but preserved inference-making capacity in very old age. Fourth-age adults may utilize more extensive semantic networks to compensate for slowed cognitive processing, achieving comprehension through sustained integration. These results have important implications for models of discourse processing and practical applications in designing reading interventions tailored to the aging population. Future research should extend these insights by investigating longitudinal changes and exploring various inference categories.

Keywords: Aging, Bridging Inference, Eye-Tracking, Reading, Word-to-Text Integration

Standards of Coherence in academic reading: Eye movement evidence for differential processing routes

Fernando Moncada

This study examines how individual differences and task goals interact to shape eye-movement patterns during academic reading. Grounded in the framework of Standards of Coherence (SoC), we asked whether reader-based SoC—operationalized through measures of cognitive motivation (Need for Cognition), reading experience (Reading History Adult Questionnaire), dispositional attitudes toward reading (Readers' Approaches to Text Questionnaire), and inferential ability (Deep Cloze test)—modulate the processing of academic texts depending on reading goals. Fifty-four Chilean university students read 16 short academic texts (150–170 words) under two counterbalanced task conditions: fact-checking and exam preparation. Eye movements were recorded using an EyeLink Portable Duo, capturing total reading time, fixations, regressions (in and out), skipping, and first fixation duration. Mixed-effects modeling revealed robust task effects: exam preparation elicited longer reading times, more regressions, more fixations, and less skipping. Crucially, several reader characteristics interacted significantly with task demands. For example, higher reading ability and cognitive motivation amplified task effects on reading time and regressions, especially under the verification condition. These results suggest that readers with different profiles adapt their processing strategies differentially depending on task context. Despite these process-level differences, comprehension scores did not significantly vary across tasks or reader profiles. Multiple regression analyses further indicated that none of the individual differences significantly predicted performance on comprehension questions. These findings provide empirical support for the interaction between situation-based and reader-based SoC. They show that readers implement distinct processing routes—conditioned by both task demands and individual dispositions—to achieve similar comprehension outcomes. This highlights the adaptive flexibility of academic reading and highlights the importance of tailoring reading interventions to both task and reader variables.

Keywords: Standards of Coherence, reading goals, individual differences, reader profiles, academic reading

Cognitive Glucose Sensitivity and Intercultural Differences in Food Cue Processing: Insights from Eye-Tracking and Cross-Cultural Research

Tobias Neukirchen, Christian Vorstius and Radach Ralph

Cognitive glucose sensitivity (CGS) measures an individual's reliance on external glucose sources for optimal cognitive performance. Our research examines how CGS shapes gaze behavior toward food cues and how cultural differences influence this effect. High CGS is associated with reduced cognitive abilities, difficulties in weight management, and poor blood sugar control. Using eye-tracking technology (EyeLink1000), we observed participants' gaze patterns on pairs of high-caloric (HC), low-caloric (LC), and non-food (NF) images. CGS was assessed with a validated questionnaire. In a pilot study, individuals with high CGS fixated longer on HC images, possibly as a compensatory mechanism. A follow-up study employed substantially improved methodology, such as a larger set of picture stimuli and a double-blind experimental validation of individual CGS, with results largely supporting the initial findings. Currently, we are conducting two new experiments to explore how gaze behavior differs across cultures, particularly in Eastern European and Asian populations. Our findings suggest that both CGS and cultural factors significantly influence how people process food cues. These insights inform the development of culturally tailored interventions to address obesity, diabetes, and cardiovascular diseases. We are eager to discuss our results in an intercultural setting and aim to expand our research to new populations. We are seeking new collaborations, especially in Latin America, to study CGS and gaze behavior in diverse cultural contexts.

Keywords: Cognitive Glucose Sensitivity, CGS, Eye-Tracking, Food Cue Processing, Intercultural

Do Deflections Disrupt Subtitle Reading? Evidence from Eye-Tracking Research

Ítalo Assis, Vera Araújo, Patrícia Vieira and Andrew Duchowski

Eye-tracking research shows viewers typically start reading subtitles by glancing at the screen's center before shifting to the subtitle's beginning, then returning to the image (Jensema et al., 2000). However, deflections — when viewers alternate between subtitles and images during reading — are often depicted in literature as indicators of disruptive reading patterns (De Linde & Kay, 1999).While most studies link deflections to less fluent processing, others argue that they may reflect adaptive strategies, especially for hard-of-hearing (Kruger et al, 2015) and deaf viewers (Vieira, 2016). Within this context, the role of deflection during subtitle processing is investigated with two subtitling variables: subtitle speed (145 vs. 180 words per minute – wpm) and number of lines (1 vs. 2). Making use of eye-tracking methodology, this study collected data from 40 Brazilian participants (20 deaf, 20 hearing) while watching manipulated movie clips with subtitles in Brazilian Portuguese. While hearing participants demonstrated more deflections than deaf participants (59% vs. 41%), a mixed-effects logistic regression model found no significant group difference. For subtitle format, 2-line subtitles triggered significantly more deflections than 1-line (66.9% vs. 33.1%). For speed, 145-wpm subtitles caused markedly more deflections than 180-wpm subtitles (77% vs. 23%). Regression modeling confirmed higher deflection probabilities in subtitles that were displayed on screen for longer periods, that is, 145-wpm, two-line subtitles (30.88%). While aggregate results across different eye metrics (mean fixation duration, latency, among others) suggested that, in general, 2-line, 180-wpm subtitles enabled more comfortable processing for both groups, the results for deflection suggest that its role in subtitle reading might be more related to longer exposure time (slower speed, multi-line subtitles) than to a cognitive load. These findings challenge the traditional view of deflections as disruptive, instead supporting the argument that they represent a natural adaptation to simultaneous multimodal processing during subtitle reading.

Keywords: Audiovisual Translation, Eye Tracking, Subtitle Reading, Deflections

Visual Processing in Flute Practice: Coupling Eye Movements, Respiratory Activity, and Anticipation

Michel Cara, Divna Mitrovic and Carlos Rojas

This study examines eye movements, breathing patterns, and performance measures in relation to learning strategies during musical practice. A group of 27 flautists with varying levels of expertise read and practiced an excerpt of Giulio Briccialdi's Duo Concertante for Flute No. 2 Op. 100. Participants were evaluated across three trials: a first sight-reading performance, a second performance after 10 minutes of self-guided practice with a metronome, and a final performance without a metronome, during which their learning strategies and the measures studied were analyzed. A multivariate analysis revealed two main components underlying single-session learning: the first was linked to attentional and anticipatory processes (blink dynamics, eye-hand span) and visual information intake (number of fixations), while the second reflected respiratory coordination and information processing (fixation duration, thoracic-to-abdominal coordination). Musicians employing a wider variety of learning strategies (combining mental practice, music structural, and technical approaches) demonstrated improved anticipation, increased blinking activity, shorter fixation duration, and more balanced thoracic and abdominal breathing patterns. Musical structure influenced significantly all studied variables, with similar response patterns observed across trials. These findings underscore the importance of employing a diverse range of learning strategies, and suggest that the integration of anticipatory, embodied, and self-regulatory processes is essential for optimizing performance in short practice sessions

Keywords: music reading, eye movements, eye blinks, breathing patterns, eye-hand span, learning strategies, embodiment

Different Strategies, Equal Success: Gendered Visual Search Patterns in Spatial Floor Plan Identification

Renate Delucchi

Gender differences in spatial cognition (such as mental rotation, wayfinding, or perspective-taking tasks) are well documented, though increasingly attributed to experience and socialization rather than innate ability. This study investigates whether men and women prefer different visual search strategies when identifying architectural floor plans based on interior 2D images. In a between-subjects eye-tracking experiment, 84 participants (53 women, 31 men) viewed grayscale interior images from 20 residences from sitcoms popular in Latin America (e.g., The Simpsons, Friends, The Big Bang Theory, How I Met Your Mother). After the residence presentation, three furnished floor plan options were superimposed sequentially. Stimuli were designed to encourage spatial reasoning without relying on architectural expertise (furnished plans, grayscale images). A post-test questionnaire collected demographic information and prior familiarity with the residences through TV or streaming. Only correctly solved trials (n = 1,210/1,640; 73.78%) were included in the analysis. Task accuracy did not differ between genders (women: M = 14.74, SD = 2.84; men: M = 14.84, SD = 2.77). AOI-based eye-tracking measures (dwell time, revisits, transition matrices) revealed distinct gendered strategies: women focused more on landmarks and movable furniture (e.g., sofas, tables) and made more frequent gaze shifts between floor plans and interiors, suggesting a comparison-based strategy. Men, by contrast, showed longer dwell times on structural features (entrances, staircases) and fixed landmarks in bathrooms, reflecting a more configural processing style. A mixed linear model accounted for familiarity, reaction time, and spatial anxiety. These findings are consistent with prior research on route directions, where women rely more on landmarks and men on structural layouts. While overall performance was equivalent, the strategies diverged, possibly reflecting differences in visual short-term working memory or spatial encoding preferences. This study adds to the growing body of research on gendered spatial cognition and real-time visual navigation.

Keywords: Gender differences, Spatial cognition, Visual search, Landmarks, Architectural plans

Incoming regressions reveal morphosyntactic information search during reanalysis

Marisol Murujosa, Carolina Gattei, Diego Shalom and Yamila Sevilla

Understanding how readers recover from syntactic misanalysis is central to sentence processing research. Syntactic reanalysis—the revision of an initial parse—often requires retrieving earlier sentence material. While regressions—backward eye movements—are known to signal processing difficulty, most studies have focused on identifying where these difficulties occur, rather than how readers resolve them. Although some efforts exist, the question of how readers resolve syntactic complexity and reanalysis remains under discussion (Meseguer et al. 2002, von der Malsburg & Vasishth, 2011, 2013). This study examines the role of case information during the processing of relative clauses. Sixty Spanish speakers read subject-relative clauses (SRC), temporarily ambiguous object-relative clauses (t_ORC), and unambiguous object-relative clauses (u_ORC). While SRCs follow the parser's preferred structure, the other two differ in when disambiguating information becomes available: in u_ORC, case-marking on the relative pronoun enables early disambiguation, while in t_ORC it is delayed until the postverbal determiner (see Supplementary Materials). Eye movements were recorded using a desk-mounted EyeLink 1000. Bayesian mixed effects Poisson models were fitted to total incoming regressions (TIR) data from correct-response trials (Figs. 1–2). Regions of interest included the pronoun and the embedded determiner. In the comparison between t_ORC and SRC, the model predicted a higher number of TIR for t_ORC at the pronoun (0.19, 95% CrI: 0.11–0.27) and the Det (0.54, 95% CrI: 0.42–0.67). In t_ORC vs u_ORC, the credible interval of the predicted difference at the pronoun includes zero, suggesting the effect is uncertain (-0.11, 95% CrI: -0.21–0.00). At the Det, TIRs were also higher for t_ORC (0.43, 95% CrI: 0.31–0.55). Our results show that readers sought case information in the pronoun and determiner when needed; and that TIR is a promising index of how readers locate morphosyntactic cues to process syntactic complexity.

Keywords: Sentence comprehension, Reanalysis, Morphosyntactic cues, Incoming regressions

Reading Between the Lines: The Influence of Vocabulary and Mentalizing on Irony Comprehension

Gabriel Perez Moya and Ernesto Guerra

Background. Irony is a form of figurative language where the intended meaning often contrasts with the literal one. While many theories are based on spoken language, reading irony also involves cognitive effort. According to the graded salience hypothesis [1], readers first interpret the most salient (often literal) meaning and only reconsider it if it doesn't fit the context. Other models, like Pexman's parallel constraint satisfaction [2], propose that multiple cues (linguistic, contextual, and social) are processed simultaneously. Eye-tracking studies suggest that irony increases reading times and rereading [3], though some findings challenge this pattern [4]. Irony comprehension has been linked to mentalizing: the ability to understand others' thoughts and intentions [5,6]. Vocabulary may also support irony processing by helping detect incongruities and interpret meanings flexibly [7]. This study examines whether mentalizing and vocabulary affect how adolescents process irony during reading. Method. An eye-tracking experiment was conducted with 118 monolingual Spanish-speaking adolescents (ages 16–18). Participants read 45 short texts (15 ironic, 15 literal, 15 fillers), each with a literal and ironic version, assigned through a counterbalanced Latin Square. Texts followed a structure adapted from Olkoniemi et al. [3]. After reading, participants answered a comprehension question. Eye movements were recorded using an EyeLink 1000 system. Measures included first-pass, regression path, and total reading time, plus comprehension accuracy. Predictor variables were scores from the Multidimensional Mentalizing Questionnaire (MMQ) [8] and the TEVI vocabulary test [9]. Results. Vocabulary, but not mentalizing, predicted irony comprehension (see Table 1). Higher TEVI scores were associated with greater accuracy (see Figure 1) and longer reading times in ironic contexts. Literal items were read faster and more accurately overall. Discussion. Vocabulary supports efficient literal processing and may enhance awareness of irony. Findings align with the graded salience hypothesis, highlighting vocabulary's role in reinterpreting meaning.

Keywords: Irony, Reading comprehension, Vocabulary, Mentalizing, Eye-tracking

Transition from the Sublexical Route to the Lexical Route in Reading among Third- and Fifth-Grade Children: The Role of Vocabulary and Phonemic Awareness

Valentina Pérez, Andrea Helo and Carmen Julia Coloma

Early reading development involves a progressive transition from sublexical-based reading towards more efficient lexical processing, according to Coltheart and Rastle's dual-route model (1994). This transition, documented in both international and Spanish-language studies (Cuetos & Suárez, 2009; Defior et al., 1996; Rau et al., 2014), is characterized by a reduction in the word length effect and an increase in the frequency effect during word reading. Linguistic factors such as phonemic awareness (PA) and vocabulary have been identified as key variables in decoding acquisition (Chávez et al., 2022; Ouellette, 2006), although their specific impact on this transition has been scarcely explored. This study examines the predominant reading route (lexical or sublexical) in monolingual Spanish-speaking children from third and fifth grade, considering the influence of vocabulary and PA on reading efficiency. Fifty-eight students participated in an eye-tracking reading task. Fixation times were recorded for high-frequency words, low-frequency words, and pseudowords, while manipulating word length (short or long). The predominant reading route was determined through the interaction between frequency and length, also analyzing the influence of linguistic skills on global reading times. In third grade, the sublexical route predominated, with a clear length effect observed across all conditions. PA was associated with better reading efficiency, especially in long words and pseudowords. Vocabulary, on its own, showed no significant effect. In fifth grade, a reduction in the length effect and an increase in the frequency effect were observed, indicating a greater reliance on the lexical route. Vocabulary, by itself, again showed no isolated effect. These findings suggest that the transition between routes is mediated by PA during early reading stages.

Keywords: Dual-route model,Reading acquisition, Phonemic awareness, Spanish-speaking children

Emotional engagement with the text influences eye movement behavior and text comprehension across languages

Victor Kuperman, Romualdo Ibáñez and Johanna Kaakinen

Reader's engagement with the text is one of the major predictors of both the real-time reading behavior (indexed by eye movements along the text) and the reading outcomes (text comprehension). While the effects of reader's engagement can be expected to hold true across different languages, to our knowledge no cross-linguistic studies have yet systematically examined and compared these effects. This project makes use of IDEST, the international database of emotional short texts (Kaakinen et al., 2022), to study the impact of highly arousing, emotionally loaded texts on the reading behavior and comprehension across English, Finnish, and Spanish. Participant samples of university students recruited in Canada, Finland, and Chile (all Ns > 30) read 24 short texts selected to represent the extremes of psychological positivity and arousal. We analyzed their eye movements, as well as accuracy of comprehension questions and self-reported assessments of their psychological states during text reading. Texts that have higher arousal ratings by participants show weaker effects of surprisal (in first fixation, gaze and total fixation duration) and weaker effects of frequency (total fixation duration). That is, arousing texts diminish the effect of semantic predictors, but the more perceptually grounded effect of word length stays the same. Also, arousing texts show higher skipping rate and lower regression rate, showing that readers speed up in these texts. The effects of the transportation scores are the opposite: Readers that are more transported by the text skip less and regress more, i.e., they read more carefully. The presentation goes over cross-linguistic similarities and differences and highlights the largely universal nature of reader's engagement as a modulating factor in the depth and quality of text reading for comprehension.

Keywords: reading, cross-linguistic studies, emotion

Cognitive processes and reading patterns in the identification of facts and opinions: an eye-tracking study with Brazilian students

Reinaldo José de Carvalho Júnior

Distinguishing facts from opinions is a key aspect of critical literacy in the post-truth era (Oxford, 2016) and amid brain rot (2023). PISA (OECD) reports that only 47% of 15-year-olds worldwide can reliably differentiate between factual and opinionated content. In Brazil, SAEB (2021) shows over 60% of 9th graders remain at the lowest reading proficiency levels. The OECD's Truth Quest Survey (2024) highlights Brazilians' struggles with misleading content, especially propaganda, stressing the need to improve informational literacy." This study examines how 6th- and 9th-grade students from a public school in Rio de Janeiro process factual and opinion-based content. Forty-eight students (24 per grade) completed an eye-tracking task with 40 syntactically matched sentences—half factual, half opinion—differing only by a critical word. This design enabled controlled comparison of sentence types while capturing real-time cognitive processing. Eye-tracking data showed that 9th graders read faster than 6th graders. For factual and opinion sentences, total reading times were 6860 ms and 6780 ms (6th) vs. 4040 ms and 3980 ms (9th). Fixation on the critical word also differed: 1420 ms vs. 780 ms (facts) and 1470 ms vs. 870 ms (opinions). ANOVAs showed a significant grade effect ($p < .0001$), with no effect of sentence or group. Accuracy results showed that 6th graders identified 40% of factual items correctly, with 25% errors and 35% doubts; for opinions, 25% were correct, 70% incorrect, and 5% uncertain. Ninth graders scored 55% correct on both types; for facts, they had 25% errors and 20% doubts; for opinions, 35% errors and 10% doubts—indicating better fluency, but persistent interpretive challenges. The data suggests that distinguishing fact from opinion remains a significant challenge, especially for younger students. This finding underscores the importance of educational intervention programs focused on critical reading skills and metacognitive strategies.

Keywords: Post-truth, Critical reading, Factual vs. opinion statements

The role of English L2 proficiency during validation processes in Chilean university students: Eye-tracking evidence

Luciano Cataldo and Andrea Santana

Validation constitutes an automatic process through which readers compare textual information with knowledge stored in long-term memory before integrating it into the situation model (Cook & O'Brien, 2014). Although previous research has explored various factors influencing this process, the effect of second language (L2) proficiency has received limited attention, despite the relevance of English as an academic lingua franca. This research examines the impact of English L2 proficiency on validation processes during reading, employing the contradiction paradigm and eye-tracking methodology. We analyzed processing patterns of 45 Chilean university students, native Spanish speakers, classified into high (≥70% on LexTALE) and low proficiency groups (<70%). Participants read English texts manipulated to generate textual consistency and inconsistency. Preliminary analyses using mixed-effects models suggest main effects of the inconsistent condition on reading measures, indicating that validation processes operate under L2 processing demands. Initial findings point to potential interactions between proficiency and condition in rereading patterns, where more proficient readers appear to exhibit more systematic processing strategies when encountering textual inconsistencies. Contrary to expectations, no significant differences in comprehension accuracy were found between proficiency groups ($p > .05$), suggesting dissociation between processing efficiency and textual comprehension in L2. Results reveal that L2 proficiency influences processing efficiency during validation but does not guarantee comprehension advantages. This research documents specific validation patterns in L2 reading, demonstrating that epistemic monitoring mechanisms are preserved, although their manifestation varies according to linguistic competence. Findings suggest the need for specific theoretical frameworks for L2 validation.

Keywords: validation, L2 reading, English proficiency, eye-tracking, epistemic monitoring

Definitely Ignored: Parafoveal Processing of Articles in Brazilian Portuguese

João Vieira, Elisângela Teixeira, Hayward Godwin and Denis Drieghe

Research on eye movements during reading has predominantly focused on content words, such as nouns and verbs, with comparatively less attention given to function words, which are often skipped or receive shorter fixations. Likewise, comparatively limited attention has been paid to parafoveal processing of syntactic information. Evidence from German (Schwalm & Radach, 2023) suggests that readers can extract grammatical gender from word n+2 when word n+1 is short. Brazilian Portuguese (BP), with more transparent gender marking than German, provides a valuable test case for further exploration of these effects. We conducted two boundary paradigm experiments to investigate whether readers of Brazilian Portuguese extract gender information parafoveally from definite article–noun phrases. In Experiment 1, the preview of the article preceding the noun was either gender-congruent or incongruent with the upcoming noun (e.g., o muro vs. a muro, the wall, in English). In Experiment 2, we manipulated the preview of the noun following an invariable article: the previewed noun either matched the target noun (e.g. o sábado/sábado, the Saturday), was a different noun with the same gender (e.g. o evento/sábado, the event/Saturday), or was a different noun with a mismatching gender (e.g. o semana/sábado, the week/Saturday). Surprisingly, Experiment 1 showed no effect of the gender mismatch when only the preview of the article changed, suggesting that readers largely ignored the gender information of the article during parafoveal processing in BP, possibly because they know gender marking repeats transparently on the upcoming noun. Results from Experiment 2, on the other hand, indicated that readers could extract gender information from the noun parafoveally, as reflected in longer fixation durations on the article-noun region when gender information did not match. Combined, the experiments show that in the parafovea the gender information in the article and noun is almost exclusively extracted from the noun.

Keywords: function words, eye movements, Brazilian Portuguese, definite articles

Does contextual diversity influence the orthographic parafoveal processing of novel words?

Ascension Pagan

Previous research shows that adults acquire words presented in different contexts more slowly during reading than in identical contexts, but words presented in diverse contexts have a larger learning advantage at post-learning; suggesting that contextual diversity contributes to context-independent semantic representations (Pagán & Nation, 2019); and consistent with theoretical models (e.g., Jones et al., 2017). However, how contextual diversity influences semantic representations and how this gain can be measured using a word learning paradigm remain unclear. Empirical evidence using a gaze-contingent invisible paradigm (Rayner, 1975) have shown that the nature of the information extracted from the parafovea can influence lexical processing during sentence reading (e.g., Schotter, Angele & Rayner, 2012). For example, Drieghe and Chan Seem (2022) showed that the number of repetitions and lexical frequency influence parafoveal processing in different ways. In this experiment, we used the invisible boundary paradigm to investigate the nature of the information that contributes to context-independent semantic representations during word learning via reading. Fifty-five adults read 42 novel words embedded in sentences while their eye movements were measured. During the learning phase, novel words were either in repeated sentences or in varied sentences. In the pre- and post-learning phases, novel words were embedded in neutral sentences, and the invisible boundary paradigm was used (Rayner, 1975). For each novel word (e.g., faddle), a valid (e.g., faddle) and an invalid (e.g., hobbta) preview were created. Results showed a replication of the contextual diversity effect (as per Pagán & Nation, 2019). Importantly, the orthographic preview benefit was greater at post-learning; suggesting that only words that are stored in memory can be parafoveally processed during reading. Although there was no evidence that contextual diversity influenced the amount of parafoveal processing, these findings indicate that orthographic parafoveal preview can serve as a sensitive index of word learning.

Keywords: Parafoveal processing, word learning, reading

How Much Do We Process Before We Fixate? Skipping Articles in Spanish

Marina Serrano-Carot and Bernhard Angele

Research question: This study examines whether native Spanish speakers use grammatical agreement information in the parafovea when reading, specifically focusing on gender and number agreement between articles and nouns. Methodology: We used the gaze-contingent boundary paradigm in two eye-tracking experiments with 24 participants each. In both studies, participants read sentences containing article-noun phrases. Before fixating the article, readers saw a preview that either matched (e.g., la mesa) or mismatched (e.g., el mesa) the upcoming noun in gender and number. An invisible boundary placed before the article triggered the correct form to appear upon fixation. We analyzed skipping rates and fixation times using linear mixed-effects models. Results: Articles were often skipped regardless of whether they agreed with the noun, indicating that grammatical agreement was not used to decide whether to skip the article. However, when there was a mismatch between the previewed article and the noun, fixation times increased on the noun (the word that followed the article). This suggests a delayed processing cost. Additionally, we compared skipping behavior between "los" (definite, masculine, plural) and "una" (indefinite, feminine, singular). Both were skipped at similar rates, showing no clear influence of article form on skipping probability. Interpretation: These findings suggest that during parafoveal processing, readers may not integrate syntactic information such as agreement between words before making skipping decisions. While mismatches do affect later processing, the initial decision to skip seems to rely on more basic visual or lexical factors rather than grammatical structure.

Keywords: Spanish reading, parafoveal processing, eye-tracking, skipping, gender agreement

Eye-movement differences in problem solving in school children: Effects of consistency and markedness

Lucía Castillo, Cristina Rodríguez, Roberto Ferreira, Romualdo Ibáñez, Bárbara Guzmán, César Campos, Cristóbal Julio and Andrea Casanova

Arithmetic word problems present a significant challenge for young learners, who need to adequately represent the mathematical operations derived from their interpretation of written text. This complex procedure depends both on their mathematical and on their reading abilities, and several factors have been suggested to explain processing differences. In particular, both the consistency (having to add when the text says "more than" and having to subtract when the text says "less than", or vice-versa) and the markedness (with unmarked 'more than' and marked 'less than' forms) of a problem have been suggested to affect problem solving in school children. In this study, we measured the eye movements of fourth grade students (32 females and 21 males, mean age 10.02, SD 0.28) while they solved arithmetic problems in four conditions: consistent vs. inconsistent with the required arithmetic operation, and with either marked or unmarked relational terms. Following Van der Schoot (2009), we divided our participants into two groups according to problem solving accuracy to analyze the reading patterns of good vs poor solvers, focusing on reading phases beyond first pass. Our results show poor solvers are affected by both consistency and markedness. A mixed model revealed a significant interaction between these two variables, with longer regression times in both consistent marked problems and inconsistent unmarked problems (interaction IRR=1.42, SE=0.23, p=0.029). Good solvers, on the other hand, are only affected by consistency, with longer regression times in inconsistent trials, across markedness conditions (consistency IRR=1.44, SE=0.17, p=0.002). Regression count models show a similar pattern, pointing to a differential effect of semantic complexity according to students' problem-solving skills. These results suggest that, in line with previous studies, Chilean school children are differentially affected by the written features of arithmetic problems according to their problem-solving accuracy.

Keywords: Arithmetic word problems, Eye-movements, Consistency, Markedness

How we read Shakespeare: Eye-tracking sentence processing in syntactically demanding texts

Daniela Cid De Garcia

This study investigates how readers process syntactically complex sentences in challenging texts, focusing on the role of syntactic awareness and executive functions in reading comprehension. Using eye-tracking, we examined how participants allocate attention and integrate syntactic constituents when reading authentic texts, including Sonnet 12 by Shakespeare. The poem exemplifies non-canonical syntax, embedding, and long-distance dependencies—features also found in many other literary and informational texts. In our experiment, university students read syntactically demanding texts under two conditions: free reading and task-oriented reading prompted by a comprehension question. Qualitative analysis of gaze plots allows us to interpret how syntactic complexity affects reading behavior, highlighting where readers struggle to integrate grammatical constituents across long sentences. We argue that this difficulty stems from limited syntactic awareness under high executive demands, particularly the ability to maintain relevant units in working memory while inhibiting distracting material. This is consistent with theoretical perspectives that emphasize the role of sentence-level processing in comprehension (Scott, 2009) and with empirical findings on the involvement of executive functions and syntactic knowledge in reading (Hung, 2020; Brimo et al, 2015). Our results resonate with recent data from international reading assessments (OECD, 2023), which suggest that many students can decode and understand short texts but struggle with longer stretches of discourse. This raises important questions about what it means to understand a sentence: as sentence length increases, readers must rely on their ability to track grammatical structures and locate the kernel sentence that carries the gist (Pressley et al,. 2023; Kintsch & Van Dijk, 1983). We propose that combining authentic, syntactically rich materials with experimental methodologies can provide valuable insight into the cognitive-linguistic mechanisms that support reading comprehension. Understanding how readers navigate complex sentence structures may help us design more effective reading instruction that bridges the gap between decoding and discourse-level comprehension.

Keywords: sentence processing, syntactic awareness, reading comprehension

Real-Time Orthographic Competition in Spoken Word Recognition: Evidence from the Visual World Paradigm

Mayte Martin-Aragoneses, Andrea Helo, Valentina Pérez, Ernesto Guerra and Carmen Julia Coloma

Different models of reading offer different views on how orthographic information is processed. The Multiple Route Model (Grainger & Ziegler, 2011) posits that beginning readers rely on fine-grained grapheme–phoneme decoding and gradually incorporate a coarse-grained route that supports position-tolerant word recognition. In turn, the Lexical Tuning Hypothesis proposes that with increased reading experience, orthographic representations become more refined and precise, reducing interference from visually similar words. Orthographic manipulations such as transposed-letter (TL; e.g., AMILENTOS for ALIMENTOS) and substitution-letter (SL; e.g., ALICENTOS) neighbors have been used to test these hypotheses. If coarse-grained processing becomes more dominant with experience, TL effects should increase with age. Conversely, if representations become more precise, TL interference should diminish. Developmental findings remain mixed, some studies reporting a decrease in TL effects with age, while others show stable or increasing effects over time (Acha & Perea, 2008; Hasenäcker & Schroeder, 2021; Lázaro et al., 2024). However, as most findings rely on offline techniques such as masked priming and flanker tasks, less is known about how these mechanisms operate during online language processing. The Visual World Paradigm (VWP) offers a valuable method to investigate orthographic processing in real time. We used eye-tracking to examine TL and SL interference in third graders (N = 29), fifth graders (N = 29), and adults (N = 27). Participants heard a spoken word while viewing four printed options: the target, a TL neighbor, an SL neighbor, and an unrelated distractor. Stimuli included 24 high- and 24 low-frequency Spanish words. Results revealed a developmental gradient: TL interference was strongest in younger children, reduced in older children, and still present—though lower—in adults. In contrast, SL neighbors caused minimal interference and attracted few fixations. These findings support the Lexical Tuning Hypothesis but also suggest that coarse-grained mechanisms remain active in adults.

Keywords: Orthographic processing, Visual World Paradigm, Reading development

Examining the Effects of Frequency, Contextual Diversity, and Semantic Diversity on Eye Movements during Reading in the MECO Corpus

Denis Drieghe and Manuel Perea

It is well documented that the eye movements on a word reflect the processing ease of that word and as a result, operationalisations of processing ease constitute an important part of computational models of eye movements during reading. However, processing ease can be operationalised in multiple ways and in this study, we examine the influence of established and some less established approaches towards capturing the impact of processing ease on eye movements. Frequency refers to how often a word occurs in a given corpus of text. Contextual diversity refers to the number of different documents or contexts (e.g., articles, books, subtitles in movies) in which a word appears. Finally, semantic diversity refers to the degree of variation in the meanings in which a word is used. These three lexical/semantic variables are all known to influence word recognition and reading behaviour. However, for contextual and semantic diversity most of the evidence to date stems from single word recognition studies conducted using a limited stimulus sets and by native speakers in their first language. Studies that take all three variables simultaneously into account are also rare. The MECO (Multilingual Eye-movement Corpus) is a large, cross-linguistic eye-tracking corpus designed to investigate reading processes across different languages (Kuperman et al. 2023). In this study, we explored the MECO to examine the effects of these variables on eye movement measures in reading in English as L1 and L2. Results show that reading times were faster when the word was shorter, more frequent, more predictable from the preceding context and for reading in L2 when the reader had a higher L2 proficiency. We also observed significant but more nuanced effects for contextual and semantic diversity. Our findings highlight the distinct and interactive contributions of these lexical/semantic factors in naturalistic reading.

Keywords: Eye movements, Reading, Bilingualism, Frequency, Contextual Diversity, Semantic Diversity

The RASTROS Corpus: A Brazilian Portuguese Eye Movement Resource with Predictability Norms

Erica dos Santos Rodrigues, Joao Vieira, Sidney Evaldo Leal and Elisangela Nogueira Teixeira

This work presents the RASTROS corpus, a collaborative multi-lab project involving six Brazilian universities, collecting the first large-scale Brazilian Portuguese (BP) eye-tracking dataset including predictability indexes (http://www.nilc.icmc.usp.br/nilc/index.php/rastros). The corpus was based on the methodology of the Provo Corpus (Luke & Christianson, 2017) and was developed to investigate linguistic predictability during reading (Vieira, 2020). Lexical predictability (based on orthographic match) and partial predictability (based on part-of-speech match) for lexical and content words were estimated from an online Cloze Task developed on the Simpligo Platform (Leal, 2021). The Cloze Task comprised 50 short paragraphs from three genres: 10 literary, 20 journalistic, and 20 pop-scientific, totaling 120 sentences and 2,494 words, of which 1,237 were unique. A total of 417 participants, all native BP speakers undergoing at least an undergraduate degree, completed the task. Each participant was assigned five random paragraphs and read an average of 245 words. Eye-tracking data were obtained from 60 undergraduate students (29 female; mean age 22.2, range 18–40) from the Federal University of Ceará, Brazil, all native speakers of BP. Participants read all 50 paragraphs in random order and answered a yes-no comprehension question after every 20 paragraphs. Eye movements were recorded on an EyeLink-1000 Hz (SR Research), and the experiment was programmed with Experiment Builder (SR Research). Detailed eye movement measures (e.g., First Fixation Duration, Gaze Duration, Go-Past Time, Skip Rates) were aligned to each word, with each word considered a separate Interest Area. Eye-tracking analyses revealed that both types of predictability facilitated reading, with lexical predictability having a stronger—although more rarely observed—effect. By adapting the framework of Luke and Christianson (2017) to BP, the RASTROS corpus offers a validated resource for psycholinguistic and computational studies. It lays the groundwork for cross-linguistic comparisons and advances research on language processing in pro-drop and inflected languages.

Keywords: Linguistic Predictability, Eye-tracking corpus, Cloze Test, Brazilian Portuguese

Reading Brazilian Portuguese across genres: insights from a passage-reading eye-movement corpus

Renan C. Ferreira and Victor Kuperman

Text genre influences reading behavior, yet few studies have addressed this question in naturalistic paragraph reading and, to the best of our knowledge, none has focused on Brazilian Portuguese. Using data from RastrOS (Leal et al., 2021), an eye-movement corpus featuring 50 authentic paragraphs from journalistic (JN), popular science (PC), and literary (LT) texts read by 37 native readers, we examine how genre modulates moment-by-moment reading behavior. Descriptive analyses showed that total fixation times (TFT) were longest for literary texts and shortest for journalistic ones. We then modelled TFT and the probability of regressions as a function of text genre, while controlling for word position within the paragraph, readability (Flesch Reading Ease), and benchmark word-level predictors (word frequency, length, and surprisal). The (generalized) linear mixed-effect models revealed a significant influence of genre on TFT, even after accounting for the control variables. We also observed significant interactions between genre and word position in the text. While TFT decreased as the paragraph progressed in all genres, this decline was the steepest in JN and flattest in LT texts. A similar interaction emerged for regressions, which were overall less frequent in JN than in PC and LT. These results suggest genre-specific reading strategies. Additional analyses considered the wrap-up effect, the oft-reported inflation of reading times at the end of the sentence that reflects the effort of semantic integration. The wrap-up effect only emerged in TFT for JN texts. This pattern did not appear in LT texts, possibly reflecting differences in syntactic structure or reader expectations. Further ongoing analyses leverage 200 textual metrics from NILC-Metrix (Leal et al., 2023) to identify which properties best differentiate genres and whether they modulate eye-movement behavior. These findings offer insights into discourse-level processing and contribute to research on naturalistic reading in Brazilian Portuguese and other underrepresented languages.

Keywords: eye movements, passage reading, Brazilian Portuguese, genre, text features

Operationalization and calculation of eye-tracking data quality measures

Diederick C. Niehorster, Marcus Nyström, Roy S. Hessels, Jeroen S. Benjamins, Richard Andersson and Ignace T. C. Hooge

Understanding the quality of eye-tracking recordings, often characterized using accuracy, precision and data loss, is crucial for the interpretation of the eye tracking data. Eye-tracking data quality can furthermore place fundamental limits on what studies can be conducted with an eye tracker. Moreover, one may be required to report eye-tracking data quality when publishing a study. But how does one determine eye-tracking data quality? This presentation will provide an overview of operationalizations of accuracy, precision and data loss and practical advice for determining eye-tracking data quality. Furthermore, numerical recipes for calculating various quality metrics for a segment of eye-tracking data are provided in MATLAB, Python and R. Also provided is ETDQualitizer (https://github.com/dcnieho/ETDQualitizer), a set of self-contained tools for determining eye tracking data quality. The implementations in the various programming languages produce identical output. We hope that this work enables any researcher to determine, critically evaluate and report eye tracking data quality, and that it spurs researchers to adopt a data quality perspective in all their future eye-tracking studies.

Keywords: eye tracking, methodology, data quality, accuracy, precision, data loss, validation, tools, software

Polygonizing Body Pose Estimation for Automatic Attentive Evaluation of Body Dissatisfaction

Nina Gehrer and Andrew Duchowski

The investigation of body-related attention processes using eye tracking is a key component of current research on body dissatisfaction and eating disorders. Therefore, an efficient assessment of fixation times towards different body parts while viewing body pictures or one's own reflection in a large mirror is critical to move the field forward. However, current analytical approaches typically require a time-consuming manual definition of all body parts as Areas Of Interest (AOIs) or rely on a frame- or fixation-based subjective rating of which body area was looked at. We previously developed an analysis pipeline for mobile eye-tracking data while looking at one's own body in a large mirror. The pipeline includes automated body detection and segmentation using Detectron2's open-source machine-learning DensePose module for body pose estimation (from Meta Research). Our first validation study showed promising results but also limitations since body segmentation only yielded pixel labeling of 25 pre-defined regions (point sets). In the current work, using the Alpha Shape Toolbox, the analysis pipeline was refined to output bounding polygons containing the point sets produced by DensePose. These polygons are then imported by DataViewer software (SR Research), allowing manual correction. As a test of the refined pipeline, we processed 144 body pictures of 96 females with varying body shapes including front, side, and back views. Automatically generated polygonal AOIs were all checked for alignment with the body areas and manually corrected if necessary. Although manual corrections were still needed – particularly for the side and the back view – the time spent on definition of AOIs was critically reduced compared to a fully manual approach. Thus, our refined pipeline can readily be used to increase overall efficiency of data analysis. Future improvements required for a fully automated analysis will be discussed.

Keywords: Eye tracking, Body dissatisfaction, Gaze analytics

How can we expand the use of eye-tracking to study reading?

Bernhard Angele, Zeynep Gunes Ozkan, Marina Serrano-Carot and Jon Andoni Duñabeitia

Fifty years ago, infrared-based eye-tracking revolutionized the study of reading. Since then, high-precision eye-tracking has contributed to many studies covering every aspect of reading and has inspired highly influential computational models of the reading process. However, the use of eye-tracking techniques is not as ubiquitous as it could be: High-precision eye-trackers are expensive and researchers in many countries cannot afford them. Projects using less expensive and precise eye-trackers often focus on global eye movement measures rather than moment-to-moment processing. In this talk, I will present several studies aimed at expanding the use of eye-tracking to study reading, taking advantage of lower-cost technologies. I will highlight (1) the role of eye-tracker sampling rate in the study of eye-movements during reading, (2) how lower-precision and online eye-tracking can be used to study reading and (3) how automated line assignment can help with the analysis of paragraph data, especially already existing data sets.

Keywords: eye-tracking, sampling rate, reading

Abstract Book

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Posters

Can higher-quality grammar education contribute to the reading process and the fight against fake news?

Eloisa Pilati, Ana Carolina Castro Rodrigues Rodrigues and Marcus Maia Maia

High levels of reading skills are important, both for understanding the world and for resisting misinformation. Studies show that these skills develop through the integration of world knowledge and reading skills (Recht & Leslie, 1988). Despite advances in reading research, the spread of fake news continues to grow globally. Multiple factors influence susceptibility to fake news, but low analytical thinking ability is among the most significant. Pennycook & Rand (2021) found that the tendency to regard semantically empty sentences (bullshit sentences) such as “The hidden meaning transforms incomparable abstract beauty” as profound correlates with lower ability to recognize fake news. In light of this, the question arises: to what extent understanding the basic structure of the grammar of natural languages contributes to critical reading? In Brazil, an innovative approach to grammar teaching has been Active Linguistic Learning (ALA), Pilati (2017). ALA is based on the analysis of the sentence as a linguistic system, promotes the relationship between grammar usage and meaning effects and innovates by using concrete materials. This study investigated the impact of ALA through two experiments: i) analysis of verbal agreement patterns and ii) recognition of bullshit sentences, involving 60 students (basic education). Both experiments used sentences of equivalent length (lexemes; syllables), and online and offline tasks. Using eye-tracking (Tobii Pro Fusion 250), a pre-test was conducted, followed by differentiated instruction (ALA vs. traditional teaching) and a post-test. Online measures included the average total duration of fixations and number of fixations; the rates of regressive fixations during the first, second and third reading passes. Analyses focused on two critical regions: the subject and verb areas. Offline measures analyzed the percentage of acceptance or rejection of the sentences. Preliminary results indicate that students exposed to ALA demonstrated greater grammatical accuracy and a more critical reading of bullshit sentences.

Keywords: reading skills, grammar, fake news, bullshit sentences, critical thinking

Predictive Processing of Accusative, Dative, and Instrumental Cases in L1 and L2 Russian: A VWP Study

Reid Vancelette

This study examines how native (L1) speakers and non-native (L2) learners of Russian use case morphology for real-time sentence comprehension, focusing on the Accusative, Dative, and Instrumental cases. Prior research suggests that while L1 speakers use case predictively, L2 learners rely more on their L1 strategies, such as word order for speakers of non-morphologically rich languages like English. Participants completed two eye-tracking tasks. Task 1, a Word Picture Matching task, assessed lexical processing and provided an individual measure of auditory-visual processing using Divergence Point Analysis (DPA). Participants heard four words in a row while viewing four pictures on a screen that corresponded to the words heard and were asked to click on the picture that matched the fourth word. Task 2, a Sentence Picture Matching task, examined whether participants used case as a cue for sentence comprehension and predictive processing, and whether this differed across case types and word orders. Participants heard sentences with different word orders and case types while viewing two semantically reversible action pictures and clicked on the picture that matched the sentence they heard. If case is used predictively, fixations towards the target should increase before the final noun. Preliminary analyses from L1 speakers show increases in target fixations in both canonical and non-canonical word orders before the final noun, regardless of case type, suggesting predictive use of case. In contrast, L2 learners do not appear to show predictive processing, regardless of word order or case type, consistent with previous findings. Ongoing analyses will evaluate whether differences in lexical processing speed (Task 1) not only correlate with L2 proficiency level but also serve as predictors in L1 and L2 sentence processing (Task 2), though additional data are still being collected to support statistical analyses and comparisons.

Keywords: SLA, eye-tracking, VWP, Russian

Linguistic Visual Attention During Sentence Planning in Spanish and English

Camilo Guerra, Matias Morales and Ernesto Guerra

This study investigates cross-linguistic differences in visual attention during sentence planning using the Visual World Paradigm, which has been stated to be useful to track the relationship between language and visual attention in real time (Tanenhaus et al., 1995), and eye-tracking technology. Fourteen Spanish and English users observed visual scenes with transitive and ditransitive events, after reading a verb in one of the two languages. Participants then produced a spoken sentence, allowing for the analysis of gaze patterns during syntactic formulation. Fixations were time-locked to verb onset and analyzed for three roles: Agent, Patient, and Object. Results showed that in ditransitive constructions, both languages prompted early attention (~1000 ms) to the Patient and Object, suggesting role prioritization aligned with conceptual accessibility (Bock & Warren, 1985). In transitive constructions, English triggered stronger fixation on the Agent (~0.4 proportion), reflecting linear subject-first planning. In contrast, Spanish displayed more balanced and variable fixations, indicating greater syntactic flexibility and possible consideration of alternative word orders, which is supported by Ferreira in languages with flexible order (2003). These results support incremental models of sentence production (Griffin & Ferreira, 2006), highlighting how attention shifts dynamically based on linguistic structure and planning demands. Furthermore, the data reveals how syntactic complexity and language-specific constraints modulate visual attention during real-time utterance planning in bilingual speakers. In addition, it also shows how important the patient and object are for the speakers when planning sentences, while the agents show less relevance overall, by being observed in the late part of the planification process. By integrating eye-tracking with the Visual World Paradigm, this study contributes to understanding the cognitive mechanisms of bilingual sentence production and informs theoretical models of cross-linguistic syntactic planning.

Keywords: Visual World Paradigm, Bilingual sentence production, Eye-tracking Visual-world, Syntactic planning

The Role of Morphophonology in Spanish-to-English Code-Switching: An Eye-Tracking Study

Daniela Castillo and Gita Martohardjono

Code-switching is a common phenomenon amongst bilingual speakers and a pervasive occurrence in multilingual urban areas like New York City. Various studies have observed an asymmetry in the distribution and processing of progressive vs. perfect constructions in Spanish-to-English code-switching (Las madres están working/*han worked today) with the progressive outranking the perfect (Dussias, 2003; Salig et al., 2023). Equivalence accounts propose that syntactically incongruent forms across two languages hinder code-switching (Poplack, 1980), but none have extended this to morphophonology. We hypothesize that structural differences in the morphology and the phonology of Spanish vs. English past participles incur processing costs and modulate perceptions of acceptability. We use an online and an offline task to investigate two characteristics of the past participle which can be incongruent across Spanish and English: verb regularity which varies across the two languages (Experiment 1, morphology) and syllable length which can be monosyllabic in English only (Experiment 2, phonology). Preliminary data (n=18) from an eye-tracking-while-reading task show that mean total reading times (RTs) at irregular participles are longer than for regular participles ($p = .003$) and longer for monosyllabic compared to multisyllabic participles ($p = .046$) regardless of switch location (at the auxiliary vs. at the participle). It is possible that bilinguals take longer to read irregular participles because they are dispreferred loci for switches (Treffers-Daller, 1994). No difference in mean total RTs at the participle region between the auxiliary switch and the participle switch were found. The acceptability judgment task revealed a marginal effect of regularity ($p = .063$) when the switch is at the participle but no effect for length. Our results indicate that the asymmetry found in the literature is also affected by morphology (verb regularity) and phonology (syllable length), suggesting a non-trivial contribution of these domains to the processing and perception of bilingual text.

Keywords: Code-switching, Bilingualism, Eye-tracking-while-reading, Bilingual sentence processing, Morphophonology

Mutual Exclusivity Survives Unreliable Speakers but Responds to Unreliable Contexts in Multiparty Conversation

Edmundo Kronmüller and Ernesto Guerra

Successful word learning often exploits the mutual exclusivity inference (MEI): listeners tend to map a novel label onto an unnamed object. Whether this heuristic adapts to the reliability of multiple interlocutors remains unclear. We addressed this question in two visual-world eye-tracking experiments that modelled multiparty discourse. Experiment 1 (N = 32 English speakers) used a between-subjects design in which participants followed pre-recorded instructions from two interlocutors: one always reused labels (consistent) and the other alternated them at random (inconsistent); a control group heard two consistent speakers. Experiment 2 (N = 44 Spanish speakers) adopted a within-subjects, face-to-face design: after a baseline with two consistent speakers, participants interacted with one consistent and one inconsistent speaker. On each trial listeners chose between a previously named object and an unnamed competitor while their eye movements were monitored. Across experiments, listeners robustly selected the unnamed referent (71.5 % and 63.5 %, respectively), confirming rapid deployment of MEI. Mixed-effects logistic models and cluster-based permutation analyses of the gaze record revealed no speaker-specific attenuation of MEI (ps > .50). Instead, the mere presence of an unreliable interlocutor produced a general, context-level reduction of the inference in Experiment 1, emerging ~650 ms after target onset. Thus, MEI functions as a default mapping strategy that withstands rapid, speaker-specific recalibration under cognitive load while remaining sensitive to the overall reliability of the conversational environment. These findings refine accounts of pragmatic plasticity by demonstrating limits on the granularity of speaker models in dynamic, multiparty conversation. Replication in English and Spanish underscores the cross-linguistic robustness of the effect and suggests that educational scaffolding should prioritise global discourse reliability rather than tailoring cues to individual speakers.

Keywords: mutual exclusivity inference, pragmatic adaptation, multiparty conversation, referential reliability, eye-tracking visual-world paradigm

Adolescents' reading times during an incidental word learning task: An eye tracking study

Ernesto Guerra, Bernardo Riffo and Andrea Helo

Adolescents frequently acquire new vocabulary incidentally while reading, yet the cognitive processes supporting this learning remain underexplored. Understanding how attentional engagement during initial exposure affects later retention is key to informing educational practices. The present study investigates the relationship between the accuracy in an incidental word learning task among adolescents and their reading times on novel (pseudo) words in context. Using eye-tracking, we examined how reading times for pseudowords embedded in sentence contexts evolved over repeated exposures and whether these reading patterns predicted successful word learning. Participants read 15 target pseudowords while their eye movements were recorded as they encountered these pseudowords in a total of 60 linguistics contexts (4 repetitions per pseudoword). After exposure, participants were tested on the number of pseudowords they were able to learn, using both implicit and explicit vocabulary assessments. Results revealed a consistent decrease in reading times for pseudowords across exposures, suggesting that repeated encounters facilitated lexical processing. Importantly, participants who demonstrated higher accuracy—that is, learned more words—spent more time reading the pseudowords during the exposure phase but only systematically on late reading measures. This positive association indicates that sustained attention during initial encounters contributes to better word retention, even when learning occurs without intention. These findings underscore the role of self-monitoring in word learning, and the value of processing time as a predictor of vocabulary acquisition and support the use of implicit contextual cues in educational materials aimed at adolescent readers.

Keywords: Incidental vocabulary acquisition, Eye-tracking, Reading times, Adolescents, Implicit learning

When Headlines Mislead: the Impact of Biased Headlines on Opinion Formation - an eye-tracking study

Renê Forster, Erica dos Santos Rodrigues, Catarina Marnet and Fernando Magalhães

Information disorder (Wardle & Derakhshan, 2017) has been extensively investigated across multiple disciplines. However, the psycholinguistic mechanisms underlying the processing of false or deceptive texts remain incompletely understood. Literature suggests that biased headlines are a common deceptive strategy (e.g., Horne & Adali, 2017; Wang et al., 2016). This ongoing study investigates a specific deceptive mechanism prevalent in 'clickbait' news, characterized by appealing headlines that, while not entirely false, are only partially consistent with the facts reported in the news body text. We examined how information presented in headlines versus body text impacts opinion formation. Thirty-two brief journalistic texts were constructed by manipulating two independent variables: congruence and valence, resulting in four conditions: positive congruent (positive headline and positive text); negative congruent (negative headline and negative text); incongruent 1 (positive headline and negative text); incongruent 2 (negative headline and positive text). Twenty undergraduate participants read these texts while their eye movements were tracked. Dependent variables included the number of fixations and total fixation duration. Participants also provided Likert scale ratings (ranging from 'very positive' to 'very negative') regarding their opinion about entities mentioned in the texts. Based on the hypothesis that headlines possess greater perceptual salience, we predicted an interaction between congruence and valence. Specifically, congruent conditions were expected to exert a stronger influence on participants' responses, with headline valence aligning more closely with Likert scores than body text valence. Regarding online processing measures (eye-tracking), we anticipated longer reading times and more fixations in incongruent compared to congruent conditions. Results are analyzed within the framework of language comprehension theories.

Keywords: information disorder, psycholinguistics, eye-tracking

Emotional Valence Shapes Reading: Evidence from Eye Movements in Brazilian Portuguese

Willamy Matos dos Santos and Elisangela Nogueira Teixeira

The relationship between emotion and cognition has been widely explored in experimental psycholinguistics (Citron & Weekes, 2013; Van Dijk & Kintsch, 1983). Research shows that emotional valence can modulate attention, memory, and comprehension during reading (Barrett, 2017; Megalakaki, Ballenghein & Baccino, 2019). However, most studies focus on isolated words or sentences in English, leaving gaps regarding text reading in Brazilian Portuguese. This study investigates how emotional valence (positive, negative, or neutral) shapes reading and comprehension processes, based on evidence from eye-tracking measures. Before the main experiment, 18 short texts were validated by 102 adult volunteers who rated each text's emotional valence on a 1–10 scale. The texts were written in the first person with indirect emotional cues. ANOVA results confirmed significant differences between groups ($F[2,1833] = 3121.54$, $p < .0001$), validating the emotional categories. In the eye-tracking study, 38 native Brazilian Portuguese-speaking university students read the 18 texts (6 per condition) in a within-subject, counterbalanced design. Data from 34 participants were analyzed after technical exclusions. Texts were matched for lexical frequency and syntactic complexity. Participants read silently while their eye movements were recorded using the EyeLink 1000 Plus system. Key measures included first fixation duration, total gaze duration, number of fixations, regressions, and accuracy in literal comprehension questions presented after every third text. Results showed no significant effect of valence on first fixation duration, but neutral texts elicited more fixations, suggesting greater cognitive effort. Emotionally charged texts were read more fluently, while neutral texts yielded higher comprehension accuracy—possibly due to reduced emotional interference. These findings demonstrate that emotional valence shapes reading behavior in measurable ways, depending on task demands and inference level. Overall, the study provides novel evidence of how emotion modulates textual processing in Brazilian Portuguese.

Keywords: emotional valence, reading, eye-tracking, Brazilian Portuguese

Psycholinguistic processing of non-canonical sentences in English-Spanish sight translation: An eye-tracking experiment

Felipe von Hausen, Lucía Castillo, Mauricio Aspé and Ernesto Guerra

In real-time language tasks such as sight translation (STR), translators must rapidly decode written input and produce a spoken equivalent. This dual processing makes STR an ideal paradigm for studying how linguistic structure and referential properties—such as syntax and animacy—interact under cognitive pressure. Previous studies [1, 2] have shown that non-canonical structures, particularly object-relative clauses, increase processing demands by deviating from canonical subject–verb–object order and reversing expected animacy hierarchies. These configurations may interfere with syntactic expectations and increase processing difficulty. This study examines how syntactic structure and animacy jointly influence online processing during STR. Twenty-one Spanish-speaking participants translated 28 English sentences [2] in a 2×2 within-subjects design crossing relative clause type (subject vs. object) with animacy (animate vs. inanimate). Examples include: "The musician that witnessed the accident…" (canonical, animate subject) and "The musician that the accident terrified…" (non-canonical, animate object). Eye movements and speech were recorded throughout the task. Mixed-effects regression models revealed that object-relative clauses with animate objects elicited significantly greater processing effort than canonical subject-relative clauses. The animate object condition showed significant effects for total trial fixation duration ($b = 0.31$, $SE = 0.08$, $z = 3.88$, $p < .001$); eye-voice span ($b = 0.43$, $SE = 0.09$, $z = 4.71$, $p < .001$); and number of fixations (IRR = 1.43, $SE = 0.06$, $z = 6.24$, $p < .001$). No significant effects emerged for inanimate conditions relative to the baseline. Interestingly, mean fixation duration was shortest in the animate object condition, suggesting a compensatory strategy of rapid, repeated fixations to resolve syntactic-referential conflict. These findings contribute to models of incremental bilingual processing and offer insight into how visual strategies support fluency when structural expectations are violated during complex language production.

Keywords: Sight translation, Relative clauses, Animacy, Eye movements, Processing effort

Analysis of Eye Movements Using Eye-Tracking in Experts and Novices Solving a Human Anatomy Task

Loida Aguirre Sánchez, Cristóbal Julio and Pablo Lizana Arce

Expertise in human anatomy enhances visual search efficiency and spatial processing. Eye tracking allows recording of attention patterns and enables comparison between experts and novices. This study examined eye movement differences in a task involving bone identification, laterality, and biological sex. A 60-item task was used, divided into three sections of 20 questions each, with images of real bones accompanied by specific questions. Measures included total fixation time, skip probability in relevant and irrelevant AOIs, and response accuracy. Participants were 6 anatomy professors (experts) and 10 first-year kinesiology students (novices). In section 1 (bone identification), experts were significantly more accurate than novices (0.72 vs. 0.48; $p = .006$), skipped significantly fewer incorrect AOIs (0.36 vs. 0.56; $p < .001$), and spent less time fixating on them ($p = < .001$). In section 2 (laterality determination), experts showed significantly higher accuracy (0.74 vs. 0.45; $z = 3.90$, $p < .001$), while fixation times did not differ for correct or incorrect AOIs. In section 3 (biological sex determination), experts had a slight accuracy advantage (0.62 vs. 0.55), consistent with section 2, but analysis is pending. These preliminary results suggest that expertise enables efficient selection of relevant information and improved task performance. These preliminary results suggest that expertise enables efficient selection of relevant information, leading to improved task performance. This highlights the potential for anatomy training to emphasize strategic visual processing and focused attention on task-relevant cues. Moreover, eye tracking proves to be a sensitive method for capturing these differences, providing valuable insights that can inform educational innovations.

Keywords: Human anatomy, University teaching, Expertise through eye tracking, Experts versus novices

Processing and Comprehension during Source Text Reading for Translation: An Eye-Tracking Study on the Effect of the Complexity of Coherence Relations

Andrea Santana Covarrubias, Stephanie Díaz Galaz and Naomi Otárola Figueroa

Reading for translation involves cognitive processes that differ from those in monolingual reading, yet little is known about how coherence relations between text segments are processed during this task. This study examines the impact of coherence relation complexity on processing and comprehension when translation students read L1 source texts. Based on Cognitive Translation Studies (Carl and Schaeffer; 2013), we test the Cumulative Cognitive Complexity Hypothesis (Evers-Vermeul & Sanders, 2009), which posits that coherence relations vary in complexity depending on their internal structure. Using a within-subject eye-tracking design, 46 translation students read 10 Spanish texts systematically manipulated for complexity (high condition: causal-negative-subjective-implicit; low condition: additive-positive-objective-explicit) while reading to translate into English. Processing patterns and global comprehension scores were analyzed. Eye-tracking data revealed that high-complexity relations elicited longer first-pass reading times ($p = 0.033$), supporting the hypothesis, while low-complexity relations unexpectedly triggered more Regressions out ($p = 0.011$), possibly reflecting strategic re-reading for translational purposes. Comprehension was not affected by complexity, suggesting the use of compensatory strategies. These findings illustrate how coherence processing is shaped by task demands and offer insights for cognitive models of translation and translator training.

Keywords: coherence relations, translation, source-text reading, processing, comprehension, eye-tracking

Effects of Reading Task on the Validation and Comprehension Process: An Eye-Tracking Study

Darguin Ramos and Romualdo Ibáñez

Validation can be understood as the process by which readers monitor textual coherence and resolve potential contradictions, both within the text itself and between the text and their prior knowledge (Singer, 2019). Given the recency of studies focused on this phenomenon, there is still no clear consensus as to whether validation is a passive process (O'Brien & Cook, 2014) or a strategic one (Richter & Maier, 2017). This study aimed to determine whether the reading task influences online validation. A within-subject factorial experiment was conducted with 55 Chilean university students who completed both a high-complexity task (fact-checking) and a low-complexity task (entertainment reading), while their eye movements were recorded using an EyeLink Portable Duo system. Fixation durations and regressions in the designated areas of interest were used as indicators of validation. In order to control for the influence of overall reading proficiency, we used the scores of the Deep Cloze Test by Jensen and Elbro (2022), adapted to Spanish by Salmerón et al. (2022). The results support previous findings, confirming that validation is triggered by inconsistencies in the information. However, our findings are inconclusive regarding whether the reading task affects validation processing both online and offline. Nevertheless, reading tasks appear to influence the strategies that readers adopt for comprehension, modulating the impact of inconsistency on understanding. These findings contribute empirical evidence supporting the notion that validation is a strategic cognitive process.

Keywords: Validation, Reading comprehension, Online processing, Reading tasks, Coherence

Perspective taking during the reading of masculine and feminine texts: Evidence from Brazilian Portuguese and English

Constance Imbault, Marina Leite, Nadia Lana, Rui Rothe-Neves and Victor Kuperman

Cognitive engagement is a crucial factor influencing reading behaviour. It can be conditioned by the attractiveness of the text (Ballenghein et al., 2023) and instructions given to the reader (Kaakinen et al., 2002). Previous studies have found that male and female-identifying readers differed in how they felt about some words (Warriner et al., 2017). We tested how the interest of gender-defined groups in the topics of the read text influences reading behaviour. In Experiment 1, 49 English-speaking participants (25F, M age 20) from McMaster University (Canada) and in Experiment 2, 21 Brazilian Portuguese-speaking participants (14F, M age 22.45) from the Federal University of Minas Gerais (Brazil) read texts while their eye movements were recorded. The texts had stereotypically "masculine" (e.g. weaponry) or "feminine" (e.g. makeup) topics. For half of the texts, participants were instructed before reading to read the texts from a man's perspective and another half from a woman's perspective. Thus, each experiment implemented the 2 (reader's self-identified gender) x 2 (text topic gender preference) x 2 (male vs female perspective) factorial manipulation. In Experiment 1, we found that male-identifying participants were more highly engaged (spent less time on) with the texts on stereotypically "masculine" topics rather than "feminine" topics, and vice versa. There was no interaction with the perspective in which the text was written. Data collection for Experiment 2 is ongoing, but preliminary results are noteworthy. When reading from the gender-incongruent perspective, both male and female readers did not vary in their reading times on words in masculine or feminine texts. However, they showed a significant change between text types when reading from the perspective of their gender. In sum, the reader's gender identity (factual or imposed by experimental instructions) can influence how a text is read, but only under certain linguistic conditions and with cross-cultural variability.

Keywords: Gender perspective, Text perspective, Reading, Eye tracking

Exploring engagement and rhetorical move processing in reading accessible research genres: a pilot study in English teacher education

Raul Garcia and Elena Panfilova

This pilot study explores pre-service English teachers' engagement with accessible research genres by analyzing reading patterns of OASIS summaries through eye-tracking. OASIS summaries (Marsden, 2018) are concise summaries of research articles in applied linguistics, written in accessible language to facilitate language teachers' engagement with research. Situated within a research literacy seminar, the study examines how students read these summaries. The purpose of our study is twofold: on one hand, we want to explore whether there exist correlations between levels of personal interest, perceived relevance, and reading patterns. On the other, we want to look into the cognitive demands of the different rhetorical moves used in OASIS summaries. For this purpose, we defined Areas of Interest (AOIs) matching the rhetorical moves used in the texts (De Santos, 1998). The following variables are considered: mean fixation duration (indicative of cognitive effort), proportion of regressions (reflecting rereading or difficulty), average saccade distance within each AOI, and total dwell time (Rayner, 1998). Additionally, syntactic complexity measures (Jagaiah, et al., 2020) are incorporated to create a multidimensional dataset linking cognitive effort with textual features, uncovering patterns that reveal students' strategies for navigating academic texts. The data from instructor-assigned summaries have been collected. The second set of data from self-selected texts will be collected shortly, with results available by early fall. The findings will inform a larger study planned for the winter semester of 2025/2026. With this study, we aim to contribute evidence on how readers engage with rhetorical structures in academic genres, an unexplored area in understanding teachers' research literacy. This study also offers practical implications for teacher education, particularly in designing pedagogical interventions that support the reading and writing of academic genres.

Keywords: Reading academic genres, Pre-service English teachers, Rhetorical moves, Eye-tracking

Processing Gender-Inclusive Morphemes in Spanish: Evidence from Eye Movements during Pronoun Reading

Alexandra Román Irizarry and Rosa E. Guzzardo Tamargo

Psycholinguistic research on gender-inclusive language has primarily focused on stereotyped role nouns (e.g., doctor, nurse), with comparatively less attention given to the processing of gender-inclusive morphemes (GIMs), particularly in real-time reading contexts. This study investigates the cognitive processing of Spanish pronouns with the inclusive morpheme –x (e.g., todxs), in comparison to canonical masculine –o (e.g., todos) and feminine –a (e.g., todas) forms, using eye tracking as the primary method. Fifty-one Spanish-speaking university students in Puerto Rico completed a sentence reading task in which critical pronouns appeared mid-sentence. Eye movements were recorded using a desktop-mounted SR Research EyeLink 1000 system. We analyzed four eye-tracking measures, including first fixation duration, gaze duration, go-past time, and total reading time, to capture both early and late stages of processing. Linear mixed-effects models revealed that pronouns with –x elicited longer first fixation and gaze durations than those with –o across all measures, suggesting increased cognitive cost. Compared to –a, –x also incurred processing costs, though these were significant only in select measures and time windows. Notably, a random-slopes correlation showed an inverse relationship between the –x/–o and –x/–a contrasts, indicating variability in how participants differentiate GIMs from canonical forms. Additionally, participants completed a post-task questionnaire capturing data regarding extralinguistic factors: gender identity, sexual orientation, attitudes toward GIMs, and experience with gender studies. Preliminary analyses suggest potential interactions between these variables and eye-movement patterns, though further research is needed. These findings highlight the importance of eye tracking in capturing nuanced processing differences in gendered and gender-inclusive language. They also underscore the value of comparing inclusive morphemes to both masculine and feminine grammatical gender baselines and examining individual variation in linguistic processing at the intersection of gender and language.

Keywords: gender-inclusive morphemes, eye tracking, sentence processing, extralinguistic factors, Spanish

Prosody and processing of garden-path sentences in Brazilian Portuguese: a Visual World Paradigm study

Vitor Gabriel Caldas

This work explores the role of prosody in the processing of garden-path sentences based on an eye-tracking experiment. The structure under study presents a verb with two clauses beginning with que 'that' (A aluna disse para a professora que chegou tarde que mora perto. - 'The student told the teacher that arrived late that she lives nearby.'). The first clause with que is temporarily ambiguous between a Complement Phrase (CP) and a Relative Clause (RC) analysis. Our research question seeks to answer whether or not prosody can guide the parser in analyzing the ambiguous sentence as a CP or as a RC during online processing. A Visual World Paradigm experiment was carried out with 32 participants who listened to 60 sentences (20 experimental and 40 fillers), distributed in a Latin Square design, and visualized two images representing both the CP and the RC analysis of the ambiguous clause on a computer screen while an Eyelink 1000 eye tracker monitored their eye movements. We adopted a 2x2 factorial design, crossing the type of prosody and the length of the ambiguous clause, with four conditions: Garden-Path Short (GPS), Garden-Path Long (GPL), No Garden-Path Short (NGPS) and No Garden-Path Long (NGPL). For the Total Fixation Duration results, a Linear Mixed-Effects Regression Model revealed significant interactions between the NGPS condition and the RC image ($p = 0.007$) and between the NGPL condition and the RC image ($p < 0.020$). For the Fixation Count results, a Linear Mixed-Effects Regression Model revealed significant interactions between the NGPS condition and the RC image ($p = 0.001$) and between the NGPL condition and the RC image ($p < 0.001$). These results show the influence of prosody on sentence processing, contradicting, in the Relative Prosody conditions, independently of length, the principle of Minimal Attachment when faced with prosodic cues.

Keywords: sentence processing, garden-path, prosody, visual world paradigm

Processing Contradictory Information: An Eye-Tracking Study of Validation Across Reading Skill Levels

Jose Garcia

Text-based validation is a cognitive process through which readers assess the coherence and plausibility of the information they process during reading. This mechanism serves as a quality control system that helps prevent the formation of inaccurate mental representations. Given its importance in comprehension, prior research has explored how various factors influence this process. The current study aims to investigate the effect of reading skill on text-based validation in Chilean students. Fifty participants took part in the study, which employed a within-subject design. Eye-tracking method was used to monitor participants' eye movements as they read short texts in Spanish designed using the contradiction paradigm. Reading skill was assessed using a Deep Cloze Test. The results revealed no significant effect of reading skill on the initial detection of inconsistencies. However, an interaction effect was observed in the engagement of repair processes: only participants with higher reading skill exhibited increased rereading and processing times in response to internal inconsistencies. These findings suggest that the ability to detect incongruences may be relatively stable across readers, but the willingness or capacity to engage in reparatory strategies is modulated by reading skills. This study contributes to our understanding of how individual differences in reading skill influence comprehension monitoring and repair during reading, highlighting the importance of supporting reading development to enhance deeper-level comprehension processes.

Keywords: reading skill, validation, text reading, eye-tracking

Through the Reader's Eyes: Tracking Cognitive and Aesthetic Processing of Metaphors in L2

Monika Płużyczka

The neurocognitive model of literary reading posited by Jacobs (2011) suggests that foregrounding devices are processed more slowly and gather greater aesthetic appreciation compared to backgrounding elements. Existing studies supporting this model predominantly focus on native speakers, leading to a gap in empirical research concerning the processing of foregrounding in a foreign language context. The findings from our previous experiments indicated that metaphors in a foreign language are processed with greater latency and are associated with heightened aesthetic appreciation compared to non-metaphorical counterparts. Additionally, we observed a positive correlation between the complexity of the metaphor and its aesthetic evaluation. Nevertheless, questions remained regarding the specific factors influencing aesthetic assessments of metaphors in a foreign language. To delve deeper into this topic we conducted experiments with a larger group of participants (60). Eye-tracking results confirmed the slower processing of metaphors. Strong positive correlations were found among aesthetic dimensions (beautiful, creative, surprising) and between these and eye-tracking measures (creativity with dwell time, beauty with revisits count and surprise with fixation count), while negative correlations emerged between comprehension and aesthetic ratings. These findings show that the processing of metaphorical expressions in L2 requires greater cognitive effort related to the difficulty in comprehending them but it remarkably enhances their aesthetic appreciation. Participants provided also feedback on why they found specific metaphors aesthetically pleasing through retrospective think-aloud protocols. The data from these sessions allowed us to classify responses into six principal categories that underpin the aesthetic evaluation of metaphorical expressions in a foreign language: positive connotations, phonoaesthetics, imaginative engagement, frequency of usage, individual attitude, and emotional resonance.

Keywords: metaphors in a foreign language, cognitive load, aesthetic evaluation, eye tracking, think aloud protocols

Prediction or Integration? Investigating the Role of Event Knowledge in Sentence Processing

Nicolás Acuña, Cristóbal Julio and César Campos-Rojas

This study investigates the role of event knowledge in predictive and integrative processes during sentence comprehension (Hintz et al., 2020; Matusalem et al., 2012). Grounded in predictive processing theories (Ryskin & Nieuwland, 2023), it examines how readers draw on prior discourse and world knowledge to anticipate upcoming input and integrate information when predictions fail. The central aim is to determine whether event-related knowledge facilitates early lexical prediction, post-lexical integration, or both. To address this, eye-tracking data are currently being collected from thirty neurotypical adult participants as they read short discourse scenarios. Each scenario includes a critical target word embedded under one of three experimental conditions: (1) highly predictable based on the preceding context, (2) low-predictability but thematically relevant (i.e., lexically anomalous but consistent with the described event), and (3) low-predictability and thematically unrelated (i.e., lexically anomalous and inconsistent with the event). To ensure attentive reading, participants answer two true/false comprehension questions after each text. The eye-tracking measures—first fixation duration, total fixation time, and regressions—will be analyzed both on the critical word and its spillover region. These metrics are intended to dissociate early predictive effects from later integration-related processes. Statistical analyses will be performed using linear mixed-effects models, with fixed effects for condition and eye-tracking metrics, and random effects for participants and items. By combining detailed eye movement data with a theoretically motivated manipulation of predictability, this study aims to clarify the cognitive mechanisms involved in sentence comprehension. The results, currently in the data collection phase, are expected to contribute to ongoing theoretical debates on the roles of prediction and integration in language processing (Nieuwland et al., 2020).

Keywords: Sentence comprehension, Predictive processing, Integration, Event knowledge, Eye-tracking

An eye-tracking study: phrasal verbs processing in L1 and L2 English

Danielle Dos Santos Wisintainer and Mailce Borges Mota

Phrasal verb is defined as a verb and a particle which is typically homonymous with an adverb or a preposition. Polysemy is one of the important features of phrasal verbs, since their meanings range on a cline from purely compositional to highly idiomatic. In relation to the compositional phrasal verbs, the arrangement between the verb and the particle are transparent, that is, their meaning is fully literal. On the other hand, in the case of idiomatic phrasal verbs it is not possible to infer the meaning of the whole combination from the meaning of their individual elements. In other words, the meaning of idiomatic phrasal verbs is figurative. In our eye-tracking study, we delved into how advanced speakers of English as L2 and native speakers of English (L1) process figurative and literal phrasal verbs in comparison to one-word lexical verbs during the reading of sentences. Twenty-four volunteers participated in the present study and read sentences containing literal meanings of phrasal verbs (e.g., put on), and their correspondent meanings of lexical verbs (e.g., apply), figurative meanings of phrasal verbs (e.g., give up), and their correspondent meanings of lexical verbs (e.g., quit). The results suggested that advanced speakers of English as L2 processed phrasal verbs and lexical verbs more slowly than native speakers of English did, and this difference is significant for figurative and literal phrasal verbs on total reading time. More specifically, results showed that figurative phrasal verbs and literal phrasal verbs were processed more slowly by nonnative speakers of English than native speakers of English. This indicates that advanced speakers of English as L2 engender greater cognitive effort in processing phrasal verbs.

Keywords: Phrasal Verbs, Processing, Eye-tracking

Effects of source plausibility and credibility on the validation process during tweet reading: an eye-tracking study in Chilean university students

Yvone Laines and Fernando Moncada

During reading, a monitoring and evaluation process occurs that contrasts the consistency of incoming information with previously read text, prior knowledge, and reader beliefs, known as validation. This process is continuous during reading, but when inconsistencies, discrepancies, or implausibility are detected in the incoming text, the reader, through the validation process, ensures coherence is reestablished in his/her mental representation. Recent studies have identified that source credibility is a key factor that influences validation. However, as this is an emerging field of study, research that has delved into this topic is limited and its results are not yet definitive. Additionally, studies examining the influence of source credibility on the validation process have primarily focused on measuring reading times, leaving it unclear how this influence manifests in eye movement patterns during validation. The objective of this study is to determine the effect of information plausibility and source credibility on the validation process during tweet reading by Chilean university students. To this end, information plausibility is manipulated through world knowledge as plausible or implausible, and source credibility according to high or low reputation, in a set of tweets. The experiment is conducted with a sample of university students, using eye-tracking technique. Results showed significant effects of credibility on fixation times in the source area and of plausibility on regression times in the text area. Significant interactions between plausibility and credibility were also observed both in regression patterns from text to source and trends in source memory. These findings contribute to understanding validation processes during reading on social media.

Keywords: validation, source credibility, plausibility, eye-tracking, comprehension

Implicit Recognition of Complex Emotions in Children's Eye Movements: A Comparative Analysis of Typical and Learning-Disordered Populations

Ernesto Guerra, Mari Aguilera, Oriol Verdaguer-Ribas, Llorenç Andreu, Mònica Sanz-Torrent and Nadia Ahufinger

Understanding how children process multiple emotional cues in real time is crucial for mapping socio-cognitive development. This study examines whether children aged 6–12 implicitly recognize complex emotions conveyed by brief spoken sentences, and how explicit verbal reporting may diverge from implicit processing. Forty typically developing (TD) children and eighty-one children diagnosed with learning disorders (LD)—including dyslexia, dyscalculia, developmental language disorder (DLD), or ADHD—participated in an eye-tracking task using iMotions software. Each trial presented one spoken sentence with neutral prosody but implicit emotional content driven by the verb, alongside four faces depicting discrete emotions. Twelve sentences featured two different emotions in sequence (e.g., sadness followed by happiness), and twelve featured a single repeated emotion. Eye-tracking data revealed that both TD and LD groups shifted gaze appropriately to each target emotion in sentences with mixed emotional content, indicating comparable implicit recognition of complex emotional contexts. However, explicit verbal reports, collected at the end of each trial, showed that children rarely articulated both emotions. The TD group identified at least one of the two emotions significantly more often than the LD group, suggesting that children with LD experience greater difficulty in explicit emotion labeling, despite intact implicit processing. These findings demonstrate a dissociation between implicit and explicit emotional awareness: while gaze patterns indicate sensitivity to sequential emotional shifts, children tend to report only a single emotion, with explicit deficits more pronounced in LD populations. Implications include the need for educational and clinical interventions that distinguish between implicit emotional comprehension and overt verbal reporting, particularly for children with learning disorders.

Keywords: complex emotion recognition, eye tracking visual-world, learning disorders, implicit processing

Prosodic Modulation of Emotional Recognition in Children With Learning Disorders: An Eye-Tracking Investigation

Ernesto Guerra, Nadia Ahufinger, Oriol Verdaguer-Ribas, Llorenç Andreu, Mònica Sanz-Torrent and Mari Aguilera

Emotional prosody plays a pivotal role in how children interpret affective states conveyed through language. This research investigates the influence of prosodic cues on emotion recognition in school-age children with learning disorders (LD) compared to typically developing (TD) peers. Eighty children with LD (DLD, dyslexia, dyscalculia) and forty TD children completed two eye-tracking experiments using iMotions software while listening to sentences and viewing four expressive faces. In Experiment 1, emotions were stated explicitly (e.g., "Laura is happy"). In Experiment 2, emotions were implicit, driven by the verb (e.g., "Cristina escapes from the dog"), with trials either congruent or incongruent between semantic content and prosody. In explicit trials, both groups showed a robust preference for faces matching the sentence content, irrespective of prosody. In implicit trials with semantic–prosody incongruence, TD children continued to rely primarily on semantic information, fixating on faces congruent with sentence meaning. Children with LD, however, displayed a significant shift toward faces aligned with prosodic cues, indicating greater interference from prosody in emotion identification. A subgroup analysis revealed that this effect was most pronounced among children diagnosed with DLD. These results suggest that, unlike TD children who discount prosodic incongruities in favor of semantic consistency, children with LD—especially those with DLD—are more susceptible to prosodic interference when decoding emotions. The findings underscore the importance of prosody in interventions aimed at improving emotional understanding in LD populations and highlight the need to tailor therapeutic strategies that reinforce semantic–prosodic integration.

Keywords: emotional prosody, eye tracking visual-world, learning disorders, developmental language disorder

Video models and the development of competencies for digital reading

Juliana Do Amaral and Mailce Borges Mota

The use of search engine tools for learning and exploratory tasks requires the development of digital competencies such as navigation across results and hyperlinked pages, evaluation of content reliability and source credibility, and integration among multiple texts – which might convey opposing perspectives on the issue. Digital competencies can be developed through video-based instruction with eye-movement modelling examples - EMMEs. While traditional video-based instruction displays a third-person perspective of the model as they do the task, EMMEs directly show the model's gaze superimposed to the visual material. This perspective is more suitable for visual attention modelling since the viewer does not switch focus between the model's face and hands. The premise is that watching EMMEs increases navigation and evaluation performance in future tasks, with extended effects on integrated understanding. Using eye-tracking to model behavior also broadens its application from language processing to instruction. In the present study, our objective was to investigate the effectiveness of EMMEs on increased attention to search engine results, to source information, and on integrated understanding in a writing task. The navigation task simulated search results comprising four webpages about learning styles (pre-test) and sports supplementation (post-test). Webpages presented either favorable or contrary views on each topic, interspersed. Participants were first/second semester undergraduate students. The control group watched a video about digital competencies of similar duration. Linear regression models will be used for data analysis with condition as predictor, and fixation on a) URLs and snippets in the search results page, b) website banner and author's photo, name, and occupation, c) reliable pages, and d) writing scores as response variables. The study is in data collection phase. Preliminary analyses will be presented in the congress.

Keywords: EMMEs, digital competencies, multiple text reading, eye movements

Anaphora Processing in Italian Monolingual and Bilingual Children: An Eye-Tracking Study of Reading Comprehension

Anna Dall'Acqua, Chiara Melloni and Serena Dal Maso

This experimental study investigates how monolingual and bilingual children process different types of anaphoric references while reading in Italian. The project focuses on the interplay between low-level (decoding) and high-level (discourse integration) reading processes (Grabe & Yamashita, 2022; Perfetti et al., 2014; 2015), addressing the underrepresentation of bilinguals in reading research. While most studies have examined monolingual children, the majority of readers globally—and in many Latin American contexts—are bilingual (Whitford & Joanisse, 2017). This study uses eye-tracking to explore global (text-level) and local (word-level) reading performance in Italian monolinguals and simultaneous bilinguals (Italian as L1, variable L2), focusing on reading for study purposes. We examine anaphora comprehension as a point of convergence between low- and high-level processes (Lumbelli, 2007; 2009; Cook & Wei, 2019). Building on Ariel's Accessibility Theory (2001), we manipulate (1) the form of the anaphoric expression with a constant antecedent (identical NP, near-synonym, demonstrative), and (2) the type of antecedent with a constant anaphoric expression (demonstrative referring to a nearby NP, distant NP, or propositional content—an anaphoric encapsulator). Stimuli are adapted from real Italian school textbooks. Participants are 90 children (grades 5–6): 34 monolinguals, 33 simultaneous bilinguals with active L2 competence, and 23 poor readers (identified through standardized word/non-word reading tests; Sartori et al., 2007). Linguistic profiles were established using tests of vocabulary (Stella et al., 2000), grammar (Suraniti et al., 2009) and working memory (Pickering & Gathercole, 2001), allowing us to relate individual differences to eye-tracking measures (Cook & Wei, 2019; Nadal Sanchis, 2024). Data will be analysed to examine associations between profiles, conditions and measures. We expect bilinguals and poor readers to show longer fixations, more regressions and increased rereading for less accessible anaphors, especially encapsulators and near-synonym anaphors. This study contributes insights into bilingual reading and anaphora processing in underexplored linguistic contexts.

Keywords: Anaphora resolution, Reading, Bilingual children, Monolingual children, Italian language, Ariel's Accessibility Theory

Differential effect of logical explicitness on argumentative comprehension

Claudia Guerra and Romualdo Ibáñez

During argument reading, comprehension is determined by the establishment of the mental representation of the logical structure of the argument. This involves identifying the ideas present in the argument (premises and conclusion), in addition to mentally reconstructing how these are connected to each other to support a position (Diakidoy, et al., 2015; Britt, et al., 2016). It often requires understanding and logically organizing a parallel line of counterarguments, reconstructing both lines of argument and identifying their relationship (Diakidoy, et al., 2015, 2017). Studies have shown that explicitly stating the premises necessary to sustain the logical connection of an argument allows more direct access to its relevant contextual and semantic information (Schwartz et al., 2018), facilitating the mental representation of the argument (Chambliss and Murphy, 2002; Malaia et al., 2014). It has also been shown that at older ages, readers achieve better interpretation of various argumentative structures (Prado, et al., 2015; Schwartz et al., 2018). Thus, argumentative comprehension depends on logical structure and developmental age, but with traditionally used offline techniques it is not possible to analyze the impact of these aspects on processing. We investigated the effect of logical explicitness and developmental age on eye movement behavior. Sixty-eight participants read brief argumentatives while their eye movements were monitored. The effect of premise explicitness was measured by the absence and presence of the major premise of the argument using linear regression models. The results show that eye movements are influenced by logical explicitness but only at a late stage of processing; moreover, this influence is not the same according to developmental age. These results have important educational implications, specifically related to the design of school texts, in addition to methodological implications regarding the way in which argument comprehension is usually investigated, especially at the school stage.

Keywords: Argumentative comprehension, Logical explicitness, Developmental age, predominance of late processing

Is grammatical gender more difficult for Chinese learners than Spanish learners of German?: Evidence from online and offline data

Leyang Ren, Sarah Schimke and Saveria Colonna

This study aims to investigate a) whether typological differences between source language and target language determine learners' sensitivity to gender markings in an L2; b) whether increasing L2 proficiency strengthens the ability of a rapid use of gender information. To address these questions, we looked at whether resolving gendered pronouns such as er (he) and sie (she) in German causes more difficulties for Chinese adult L2 learners than Spanish learners. In the experiment, participants viewed a picture representing a male and a female protagonist while hearing a sentence (see examples in 1). We tested 30 native speakers, 60 intermediate-advanced Chinese and 60 Spanish learners of German and measured their eye movements and forced choices. (1) Example sentences: Die Bäuerin hat den Kapitän getroffen, (The farmer(f) met the captain(m),) a. Topic continue: danach ist sie zur Arbeit gefahren. (after that, she went to work.) b. Topic shift: danach ist er zur Arbeit gefahren. (after that, he went to work.) Wer ist zur Arbeit gefahren? (Who went to work?) The offline results showed that a) the topic shift condition (see 1b) are more difficult for learners than the continue condition (see 1a), suggesting that learners sometimes relied on an information structural cue instead of gender marking. b) Spanish learners had better command of gender information than Chinese learners. Importantly, we found a main effect of L1 for learners at same proficiency level. c) Efficient use of grammatical information is correlated with language proficiency, and advanced learners exhibited a target-like performance. These findings mirrored online processing, where Spanish learners rapidly used the gender information, while Chinese learners exhibited weak sensitivity to the gender cues. We conclude that the processing of grammatical gender is shaped by topological differences between L1 and L2. However, the interlingual interference can be substantially reduced by increasing proficiency.

Keywords: gendered pronoun resolution, gender cues, L1 interference, language proficiency

Possibilities of using eye-tracking research in linguistics – plain language perspective

Magda Zelazowska-Sobczyk and Joanna Osiejewicz

This presentation explores the possible application of eye-tracking in linguistic research. It focuses on plain language and draws on two interdisciplinary legal and medical communication studies. The first study, conducted in May 2024 during the workshop "Unlocking Understanding: An Interdisciplinary Exploration through Eye-Tracking Research on the UN Disability Rights Convention" at the University of Coimbra, examined differences in reading strategies between the original and plain language versions of Article 8 of the Convention. Eye-tracking data from law students and students of international legal communication showed that non-specialists benefited from simplified texts, as evidenced by shorter fixation times and scan paths. The results highlight the importance of linguistic clarity in legal documents intended for broader audiences. The second study evaluated the readability and usefulness of a plain-language booklet with post-surgical guidelines for caregivers of children after common ENT surgeries. Conducted in June–July 2024, this study involved eye-tracking and questionnaire responses from 15 participants. Preliminary results showed that the specialised terminology and layout generally supported understanding. At the same time, some graphic elements could be reduced or simplified for improved clarity. Both studies demonstrate how eye-tracking can uncover detailed patterns in readers' visual attention and comprehension strategies, offering valuable insights for creating accessible, user-oriented texts. By combining linguistic analysis with visual processing data, researchers and practitioners can better design legal and medical materials (specialised materials and documents in general) that meet plain language standards and enhance public understanding.

Keywords: eye-tracking, linguistics, plain language, medical communication, law, interdisciplinary research

Neologicity and Cognitive Processing: A Psycholinguistic Approach to Lexical Innovation

Paola Cañete-González, Carolin Adam, Carole Garidel, Constanza Becerra Fuentes, Boris Pradel and Mabel Urrutia

One of the central aspects of neology involves the degree of neologicity of emerging lexical units. According to Cabré, Domènech, Estopà Freixa and Solé (2004), the novelty of a word is a relative phenomenon defined by the neologicity criterion, as intuition suggests that some units are more neological than others. Authors such as Cabré et al. (2004) have suggested the following criteria to determine the degree of neologicity: a) presence of the neologism in other sources, b) frequency of use; c) deviation from standard dictionaries, d) word formation rules, and e) borrowing from other languages. Freixa (2010) adds that neologicity also involves subjective perception, which can be objectifiable and measurable. Since neologicity is an experiential phenomenon based on perception, it is suggested that eye movements such as fixations, saccades, regressions, and refixations may provide evidence of certain eye patterns related to the degree of neologicity. Therefore, words that are longer, rarer, or less predictable tend to cause longer fixations and more regressions. For this purpose, a neological corpus was compiled, whose units were extracted from the Obneo platform and organized by levels of frequency of use. Then, these units were used to construct syntactically similar sentences, which were presented to a group of subjects, whose eye movements were measured using the eye-tracking method, to examine how these characteristics interact with the speakers in relation to cognitive effort. The research focused on two aspects of language: the morphological structure of neologisms (number of syllables, morphological composition) and the degree of neologicity (measured in terms of frequency). As a result, it is expected to verify the initial hypothesis that a higher fixation is associated with a higher degree of neologicity.

Keywords: neologism, neologicity, eye-tracking, cognitive effort

A low-cost remote eye tracker with stroboscopic differential lighting

Harre Bams Ayma Aranda and Carlos Hitoshi Morimoto

Eye trackers are essential devices used for eye movement research. High end commercial eye trackers can be very expensive, over US$ 20,000 and, even simpler models such as PupilLabs, cost over EU$ 3,000. In this work, we present a fast, accurate, and robust low-cost remote eye tracker that employs a single webcam and stroboscopic near infrared (NIR) LEDs. The cost of the hardware components is under US$100. Our method is based on differential lighting pupil segmentation (DLPS) technique, that exploits the dark-bright pupil effect to accurately and robustly segment the pupils. DLPS was developed in the late 90s for analog cameras, and we have extended the method to be compatible with modern digital cameras using stroboscopic lighting. Two sets of NIR lights are employed. One set is placed near the optical axis of the camera to generate bright pupils and another set is placed off-axis to generate dark pupils. Pupils are segmented from the difference between bright and dark pupil images. A similar idea has been used for head mounted eye trackers, but have not yet been used in remote eye trackers, where the design of the illuminators are more challenging. Once the pupils are segmented, the center of the pupil in the bright and dark pupil images are refined to improve accuracy. Our current implementation uses an old PS3 camera that can deliver 120 fps and an arduino to control the two sets of NIR LEDs. Our experiments show that the accuracy of our current implementation is below 1.5 degrees using a 9 point calibration procedure to compute a second order polynomial. Further research is being conducted to improve accuracy by exploiting other calibration methods, such as homographies, and using better cameras, with higher resolution. Both hardware and software will be open source.

Keywords: Single Camera Eye Tracking, Calibration, Stroboscopic Illumination, Near-Infrared Light, Pupil Detection

Virtual Reality-Based Training to Enhance Vowel Perception in Chilean EFL Learners

Diego Sanhueza

This study investigates the use of Virtual Reality (VR) as a pedagogical tool to improve vowel perception in Chilean high school students learning English as a foreign language (EFL). Spanish-speaking learners often struggle with the perception and production of English vowels that do not exist in their L1 phonological inventory, particularly /æ/, /ʌ/, /ɪ/, and /iː/. Misperceptions of these sounds can impair intelligibility, lexical access, and general communicative competence. A pre-post quasi-experimental design was employed with 16 secondary EFL learners (A2 CEFR level). Participants were exposed to 16 immersive VR sessions (20 minutes each), during which they interacted in multisensory environments containing target vowel contrasts. Two perception tests were used: a Four-Alternative Forced Choice (4AFC) Identification Task and an AX Discrimination Task. Both tests were administered before and after the intervention. Results revealed significant improvement in both identification (e.g., /æ/ from 45% to 76%) and discrimination accuracy (e.g., /ɪ/ vs /iː/ from 51% to 81%). These findings suggest that VR-based vowel training fosters more robust phonological categories, likely due to enhanced auditory salience and contextualised exposure. The results align with the Speech Learning Model (Flege, 1995, 2021) and support usage-based accounts of L2 phonological acquisition. This research contributes to the field by proposing an accessible, immersive, and effective intervention method for phonetic development in EFL learners. Although no eye-tracking was used, the study invites future investigations that combine immersive media with real-time eye-movement data to better understand attention patterns during L2 phoneme processing.

Keywords: vowel perception, English as a foreign language, virtual reality, phonological acquisition, L2 speech processing, immersive learning

Processing functional and content words in reading Spanish text: An eye-tracking investigation

Gabriela Becerra, Rodrigo Ponce De León, Ariel Cuadro and Imran Hossain

Readers need to distinguish between content and function words, allocating cognitive resources in a differentiated manner to efficiently reconstruct the meaning of a written text. Studies conducted in languages such as Persian, Polish, and English have demonstrated distinct processing between these two types of words during reading; however, studies in Spanish are scarce. The objective of this research is to observe the processing of functional and content words in Spanish using eye-tracking techniques. Furthermore, it is proposed to explore differences in this processing between readers with typical development and readers with dyslexia. Methods: The subjects of this pilot study were two university students, one with dyslexia and one typical reader. The data were obtained from reading a narrative text using the Gazepoint program. The words in the text were classified as functional or content words, and the frequency and duration of eye fixations were analyzed to compare their processing. Results: The results revealed that both readers made a greater number of fixations, and fixations of greater duration on content words compared to functional words. However, the reader with dyslexia showed a higher number of eye fixations on functional words compared to the typical reader. Conclusions: The parameters of duration and frequency of eye fixations were contrasted according to the type of words and the readers' profile in Spanish. It showed that, akin to patterns observed in other languages, functional and content words undergo distinct processing during the reading of Spanish texts. This aligns with insights from prosodic reading research, highlighting the unstressed nature of functional words in contrast to the stressed nature of content words. Eye-tracking technologies could help reveal how functional and content words are processed in Spanish, shedding light on decoding difficulties in dyslexic readers and their impact on the ability to group words into rhythmic-accentual units.

Keywords: prosody, eye tracker, function words, content words, dyslexia, eye movement

How Enjambments can Influence the Garden Path Effect: An Eye-Tracking Study

Gabriela Detoni Rodrigues and Aline Alves Fonseca

The spatial-visual organization of poetry results in a reading and cognitive processing different from other types of text. One stylistic device the poet can use is the enjambment, which can be either prospective, when it is clear that, at the end of the verse, there is no phrase boundary, or retrospective, when there can be a phrase boundary at the end of the verse, but there is not (Golomb, 1979). Retrospective enjambments may not be perceived as such, which constitutes a case of ambiguity. Ambiguity leads to an erroneous interpretation of the sentence, which is called the Garden Path effect (Frazier, 1979). Given this context, we assessed, through eye-tracking tests, how the type of enjambment influences the Garden Path effect; especially, in the case of retrospective enjambments, whether a line break in the middle of the phrase causes this effect, resulting in more regressions and longer fixation times. We used classic temporarily ambiguous sentences (Frazier, 1979), manipulating the correspondence between line breaks and phrase breaks (e.g.: “While Mary was mending (V1) / the sock (NP) / fell (V2) off her lap” vs. “While Mary was mending the sock / fell off her lap”). We used, as control, the same text in prose form. The study was conducted in Portuguese. The data were analysed through linear regression tests, using the software RStudio. The results indicate that prospective enjambments do not generate a statistically significant Garden Path effect (TFD: B=-0.10, CI=[-0.28~0.09], p>0.1), since the line break induces a phonological boundary between the V1 and the ambiguous NP. On the other hand, retrospective enjambments seem to generate an even stronger Garden Path effect than prose does (TFD: B=0.22, CI=[0.03~0.41], p<0.03), by keeping together in the same verse the V1 and the ambiguous NP, separating the NP from the V2 in different verses.

Keywords: enjambment, Garden Path, eye-tracking, poetry, sentence processing

Semantic Gender and Clefting in the Processing of Ambiguous Replacive Ellipsis Sentences

Julia Greco Carvalho

This study investigates the influence of semantic gender and syntactic clefting on the processing of ambiguous sentences in Brazilian Portuguese with replacive ellipses, such as: Na mansão luxuosa foi a criada que a estrela cumprimentou educadamente, não a cantora. In the luxurious mansion, it was the maid that the star politely greeted, not the singer. According to Carlson's (2001) Parallelism Hypothesis, the sharing of features between Determiner Phrases (DPs) facilitates the disambiguation of elliptical sentences. Vigliocco and Frank (1999) argue that semantic gender (linked to real-world referents) plays a more effective role in grammatical encoding than grammatical gender, due to its conceptual salience. To test this, an eye-tracking (Eyelink 1000) reading and interpretation experiment was conducted based on two main hypotheses: (i) semantic gender facilitates parallelism more effectively than grammatical gender; (ii) semantic gender parallelism enhances the syntactic focus effect of clefting, stronger in Brazilian Portuguese. The experiment manipulated two factors: cleft focus (subject vs. object) and gender parallelism (with the subject vs. with the object), forming four experimental conditions: COPO, COPS, CSPO, and CSPS. Each condition was represented by 16 target sentences, paired with comprehension questions requiring participants to resolve the ambiguity of the DP, along with 16 filler items. Materials were Latin-squared across four lists and presented to 36 undergraduate students. Results showed a significant effect of gender parallelism on sentence processing. Participants took longer to interpret the ambiguous DP in mismatch conditions ($\beta = 0.13$, CI [0.02 ~ 0.24], $p \approx 0.02$), indicating higher processing costs when the focus mismatched the target. Additionally, subject parallelism increased fixation counts and regression durations on the high-attached DP ($\beta = 0.14$, CI [0.01 – 0.27], $p = 0.031$), suggesting that semantic gender cues, along with syntactic prominence, attracted visual attention.

Keywords: Psycholinguistics, Sentence processing, Semantic gender, Cleft, Parallelism

Literacy and Spatial Cognition: Eye-Tracking Evidence from Thematic Role Representation in Brazilian Portuguese

Rachel D'Ippolito, Dominick Maia Alexandre, Luiz Vinicius Gadelha de Freitas and Elisangela Nogueira Teixeira

This study investigates the relationship between language and spatial cognition, focusing on how literacy influences the spatial representation of thematic roles in active and passive sentences. Specifically, we examine whether agent–patient mappings reflect biological predispositions or are shaped by cultural factors, such as the direction of writing. Building on work by Chatterjee et al. (1999) and Maass & Russo (2003), we address a gap in the literature by examining spatial preferences among illiterate adults. We designed a sentence–picture matching task combined with eye-tracking to assess whether illiterate individuals exhibit horizontal spatial biases. Thirty literate and ten illiterate native Brazilian Portuguese speakers participated. In each trial, participants heard a sentence (e.g., “The boy pushes the girl”) and viewed four images arranged in a 2×2 grid: (i) target (agent left, patient right), (ii) competitor (agent right, patient left), and two distractors. Sentences varied by voice (active/passive) and verb type (agent→patient, patient→agent, emotion). Linear mixed-effects models analyzed reaction time, fixation time, number of fixations, and mouse click. Illiterate participants showed longer reaction times ($\beta = 628.8$ ms, $p = .001$) and greater sensitivity to passive voice ($\beta = 238.5$ ms, $p = .001$), with significant group × verb type interactions. Fixation time and number of fixations were also significantly higher among illiterate participants ($p < .001$), especially for passive sentences and competing images. Despite these cognitive costs, both groups performed similarly in image selection. Findings support the view that reading and writing practices shape not only linguistic competence but also spatial cognition. The spatial representation of thematic roles appears to be culturally influenced rather than universally biological, offering novel insight into how literacy modulates event processing.

Keywords: literacy, spatial cognition, thematic roles, sentence processing, eye-movements

Which textual features actually influence natural reading behavior? A correlation analysis of NILC-Metrix measures and eye-tracking data from Brazilian Portuguese

Renan C. Ferreira, Beatriz N. Carvalho, Victor Kuperman and Rui Rothe-Neves

The literature on text complexity offers dozens of linguistic metrics that are said to influence reading, but, to the best of our knowledge, few studies have tested multiple metrics against the same dataset of naturalistic reading behavior. In this study, we investigated which features among the 200 metrics computed by NILC-Metrix (Leal et al., 2023) are significantly associated with variation in eye movements during paragraph reading. We used data from the RastrOS corpus (Leal et al., 2021), which includes eye-tracking recordings from 37 adult native speakers of Brazilian Portuguese reading 50 short, authentic news, pop-science, and literary paragraphs. For each paragraph, we calculated the mean total fixation time per word and gathered the full set of NILC-Metrix measures, covering lexical, syntactic, psycholinguistic, and discourse-based dimensions. We computed Spearman correlations between each textual metric and the mean reading time per word, applying false discovery rate correction (FDR, $\alpha = .05$) for multiple comparisons. Out of 200 metrics, only six showed significant correlations. Most of them were frequency-related measures (e.g., mean Zipf-scale frequency for content words, across two reference corpora). These metrics were negatively correlated with reading time, consistent with the well-established facilitative effect of lexical frequency. The Flesch readability index – which is a mathematical function of mean word length and the number of words in a sentence – also showed a significant negative correlation. Our results suggest that only a small subset of complexity metrics that are directly related to benchmark lexical properties (word length and frequency) and sentence length are meaningfully associated with reading effort. Scores of other properties offering more elaborate syntactic measures (e.g., tree depth) or lexical measures (e.g. mean word concreteness) are not predictive of reading times. These findings offer insights to inform future investigations of text feature effects on eye *movement behavior during natural reading.*

Keywords: eye movements, passage reading, Brazilian Portuguese, text features

Exploring the Impact of Virtual Pet Interaction on Anxiety and Stress in University Students: A Pre-Post Quasi-Experimental Study

Francisca Villablanca and Pablo Vergara

Anxiety disorders are increasingly prevalent among university students, significantly affecting both well-being and academic performance. In response, innovative therapeutic alternatives have emerged, including the use of Virtual Reality (VR) to create immersive environments for emotional regulation. A recent line of interest involves the interaction with virtual pets within the metaverse, grounded in empirical evidence that links contact with animals to reductions in anxiety and stress-related symptoms. This study proposes a quasi-experimental pre-post design to evaluate the impact of virtual pet interaction on levels of anxiety and stress among university students. The sample will consist of 50 first-year Psychology students who, during the two weeks leading up to a major examination, will engage in 20-minute VR sessions twice per week. These sessions will take place in a metaverse environment featuring virtual pets designed for emotional support. Anxiety levels will be measured using the SISCO Academic Stress Inventory, administered before and after the intervention. Statistical analysis will be conducted to compare pre- and post-intervention scores. It is hypothesised that post-intervention anxiety levels will show a statistically significant reduction, supporting the idea that controlled exposure to virtual pets may positively influence academic stress management. The study will also explore whether the effects vary according to gender or interaction modality (individual vs group interaction within the metaverse). Findings are expected to validate the therapeutic potential of VR in educational contexts and provide empirical support for brief, accessible, and technology-mediated interventions. The study could inform future research on emotional well-being among students and contribute to the integration of emerging technologies into academic support programmes.

Keywords: Virtual reality, Virtual pets, Academic stress, University students, Anxiety reduction, Metaverse, Therapeutic intervention

Reading Between the Idioms: Context Effects on Verb-Based MWEs in Chilean Spanish

Américo Narea and Ernesto Guerra

Multiword expressions (MWEs) are constructions that function as semantic and syntactic wholes and are prevalent in everyday language. Despite extensive studies in English, empirical evidence on how MWEs are processed in real-time in Chilean Spanish remains limited. This report presents data from an eye-tracking study examining the role of linguistics context in reading MWEs. Data was collected from 27 native Spanish-speaking participants. Each participant read 20 verb-based MWEs under two conditions—idiomatic and literal. To ensure measurement reliability, every expression was repeated four times, resulting in a total of 80 trials per participant. Linear mixed-effects regression analyses revealed no significant differences between idiomatic and literal contextual conditions for first-pass fixation durations (estimate = -10.30 ms, SE = 8.97, t = -1.15, p = .262) or regression-path durations (estimate = 36.28 ms, SE = 34.31, t = 1.06, p = .299). However, total reading times on the target regions showed a reliable effect of condition: the idiomatic context elicited a 43.34 ms reduction in total reading time compared to the literal context (estimate = 43.34, SE = 19.86, t = 2.18, p = .038). We are also planning to integrate participants' self-reported familiarity ratings for each MWE to further disentangle how subjective knowledge and conventionality interact in driving reading efficiency. These results provide first evidence for the impact of contextual constraints on MWE real-time processing in Chilean Spanish, these early findings lay the groundwork for a deeper understanding of how multiword constructions are integrated during reading on this language.

Keywords: Multiword Expressions, Idioms, Eye-tracking Reading, Contextual Constraints, Chilean Spanish

Visual Fluency and Multimodal Reading: Eye-Tracking Evidence from Conventional and Non-Conventional Comics

Marcella Campos E Souza and Aline Alves Fonseca

This study investigates how readers with varying levels of familiarity with comic books (HQs) allocate their visual attention when reading different text types: prose, conventionally formatted comics (HQC), and non-conventionally formatted comics (HQNC). Conducted in Portuguese, the research employed eye-tracking using a Tobii TX300 device to measure total fixation duration (TFD) across defined areas of interest (AOIs), and to explore how visual language fluency relates to comprehension. Grounded in multimodality theory (Kress & Van Leeuwen, 2001; Kress, 2003) and the concept of visual language fluency (Cohn, 2013), the study views comics as multimodal texts that require the integration of verbal and visual information within complex spatial layouts. Undergraduate participants (N= 21) were categorized into high, intermediate, and low fluency groups using a questionnaire adapted from Cohn (2013). Each participant read one prose excerpt, one HQC page, and one HQNC page, followed by comprehension questions. Statistical analysis, conducted using RStudio, revealed significant effects for both text type and reader fluency. HQNC required more visual attention than HQC, especially in image-based AOIs (B= 0.15, CI [0.06 ~ 0.24], p= 0.002). High-fluency readers exhibited shorter overall TFDs compared to intermediate and low-fluency participants (B= -0.03, CI [-0.05 ~ -0.01], p= 0.016), indicating more efficient processing. In terms of comprehension, prose yielded the highest rate of correct responses, with a significant difference between prose and HQC (B= 0.27, CI [0.09 ~ 0.71], p= 0.011). HQNC led to the highest image-based comprehension scores, while HQC showed the lowest. Interestingly, intermediate readers outperformed advanced readers overall (B= 3.18, CI [1.02 ~ -10.84], p= 0.053), suggesting a more deliberate reading approach. The findings confirmed significant differences between fluency levels and text types, especially regarding TFD and image-based comprehension, highlighting how these two factors influence visual attention.

Keywords: Comics, Reading, Eye-Tracking

Comparing wearable and stationary eye-tracking systems in a sentence comprehension task: A validation pilot with adult Spanish speakers

Analí R. Taboh, Diego E. Shalom, Camilla D'Augè, Yamila Sevilla, Camilla D'Augè and Carolina A. Gattei

Wearable eye-tracking technology offers new opportunities for studying language comprehension in more naturalistic contexts, especially with populations such as young children. Some studies support the reliability of wearable eye-tracking systems [1], while others have raised concerns [2]. Although there is growing interest in using eye-tracking glasses in developmental research [3, 4], to our knowledge, no studies have assessed the validity of these systems for investigating syntactic processing. We present a pilot study comparing the performance of a wearable and a stationary eye-tracker in a sentence comprehension task previously used with children. The aim is to evaluate whether data from eye-tracking glasses are comparable in quality and interpretability to those obtained with a stationary system, and to ensure that the glasses are suitable for use in future studies with children. Twelve adult native speakers of Spanish will complete the same task twice, once with each eye-tracking system (counterbalanced order): Pupil Labs' Neon glasses and Eyelink 1000. Sentences with five different syntactic structures will be assessed: simple active sentences with canonical and noncanonical word order, passives, and subject and object relative clauses. The task is a sentence-picture matching task with sentences presented auditorily together with two images displayed on a screen: one depicting the described event and another showing reversed thematic roles. Participants select the image matching the sentence while their eye movements are recorded. Data collection is currently ongoing. Data will be analyzed to assess the comparability of accuracy and gaze patterns across systems. We will focus on the proportion of fixations to the target image relative to trial onset in correct and incorrect trials, to examine whether both devices reveal consistent effects of sentence structure. Preliminary results will be discussed in terms of their interpretability relative to previous studies using similar paradigms with eye-tracking to study sentence comprehension [5, 6].

Keywords: wearable eye-tracking, incremental language processing, sentence comprehension, developmental research

Inferential processing in the reading of complex sentences

Sabrina Santos

This study investigated inferential processing in the reading of complex sentences with causal relationships. Through an eye-tracking experiment, reading data from two groups were compared: elementary school (ES) students, considered less skilled in reading, and higher education (HE) students, considered more skilled. The objective was to evaluate how these different groups behaved when faced with direct causal relationships (e.g., A aluna recebeu os parabéns porque/já que ela obteve sucesso no exame do ENEM), in which causality occurs objectively between the meanings of the clauses, and indirect causal relationships (e.g., A aluna escreve textos bons porque/já que ela obteve sucesso no exame do ENEM), in which causality requires the derivation of inferences by accessing extra-clausal information. This second type of causality has been reported as more complex to process, possibly because it involves a logical fallacy that demands more inferential calculations to be computed. The manipulation of groups aimed to reveal whether less skilled readers are also sensitive to distinctions in causal computation. Additionally, the role of the connectives "já que" and "porque" was analyzed. The hypothesis entertained was that the connective "porque" would serve as the default operator of causality and thus would have a facilitating effect in direct causality, which exhibits the prototypical effect-cause order. The results indicated a significant main effect for the three factors: group ($F(1,188)=9.24$, $p<0.05$*), causality ($F(1,188)=24.2$, $p<0.05$*), and connective ($F(2,376)=19.1$, $p<0.05$*). It was found that indirect causality is more costly to process for both groups. However, regarding the role of the connectives, it was observed that the connective "já que" interferes differently in reading processing, particularly in its initial stage.

Keywords: Sentence Processing, Reading, Inference

Psycholinguistics and Multimodality: interaction between linguistic and visual processing

Aline A. Fonseca, Francisco Vieira and Camila Leite

This study examines the representational relationship between written language and visual content in image-caption pairs from the Framed Multi30k corpus (Torrent et al., 2022), integrating insights from Frame Semantics (Fillmore, 1982) and Psycholinguistics (Rayner, 2009). Our main objective is to assess whether reading verbal information influences how participants observe and process visual scenes. We conducted an eye-tracking experiment using the Tobii TX300 with 24 participants. Sixteen images were shown, each accompanied by a caption in Brazilian Portuguese. These captions were adapted to include additional details about the visual scene, such as environmental features and background elements. Experimental items were presented under two conditions: CBI (Caption Before the image) and CAI (Caption After the image), and distributed across two groups using a Latin Square design. Each trial ended with a comprehension question. Areas of Interest (AOIs) were categorized as "Primary" (foreground and main clause content) or "Secondary" (background elements linked to subordinate clauses). A linear regression model (R Core Team, 2024) revealed that Secondary AOIs in the CBI condition received significantly longer fixation times compared to those in the CAI condition (β = -0.21, CI [-0.37 ~ -0.06], p = 0.007). Participants also spent less time reading captions when they appeared after the image (CAI) (β = -0.30, CI [-0.41 ~ -0.18], p = 0.002). These results suggest that verbal processing shapes visual exploration and that visual input, in turn, facilitates verbal comprehension. This interplay between modalities influences eye movement patterns and reduces reading time for descriptive texts in multimodal contexts.

Keywords: Multimodality, Eye Tracking, Linguistic Processing, Visual Processing

Eye-Tracking Exhaustivity Violations in It-Clefts and 'Only'-Sentences

Bianca Lignani, Aline Fonseca, Kevin Paterson, Victoria McGowan and Ascensión Pagán

This paper investigates two types of structures: a) sentences with the adverb 'only'; and b) it-clefts. Given a context such as (1) 'Anna and Olivia run a busy bakery in London', sentences like (1a) 'Yesterday Anna brewed coffee and pastries too' and (1b) 'Yesterday, Anna brewed coffee and Olivia did too' are perfectly plausible. In (1c) 'Yesterday, only Anna brewed coffee and pastries too' and (1d) 'Yesterday it was Anna who brewed coffee and pastries too', the actions are exclusive to Anna, which implies that Olivia did not brew anything. This can be explained with the semantic effect of exhaustiveness that both clefts and adverbs imply (Kiss, 1998). However, in: (1e) 'Yesterday only Anna brewed coffee and Olivia did too' and (1f) 'Yesterday it was Anna who brewed coffee and Olivia did too', the expected exhaustiveness is violated. We developed an eye-tracking experiment in which participants (n= 30) read sentences like (1a)-(1f) after having read a context-sentence, such as (1). We ran a linear regression model (lmer) on RStudio (R Core Team, 2025). Our findings confirmed our first hypothesis: non-exhaustive it-clefts elicited significantly shorter regression path durations than non-exhaustive 'only'-structures (β = -0.19, SE = 0.03, z = -5.71, p <.001). This corroborates the idea that the semantic effect of exhaustiveness in 'only'-sentences is stronger than in it-clefts. That would be because 'only' affects the truth conditions of a sentence (Rooth, 1992), whereas exhaustiveness in it-clefts derives from conversational implicatures (Drenhaus, Zimmerman & Vasishth, 2011). Unexpectedly, non-exhaustive conditions were processed faster (β = –0.0886, SE = 0.0273, z = –3.25, p = .0012) than exhaustive conditions, regardless of the structure (baseline, it-clefts and 'only'-sentences). We believe that this might have been because the cooperation introduced by the context-sentences facilitated non-exhaustive readings (Destruel et al., 2015; De Veaugh-Geiss et al., 2018).

Keywords: Exhaustiveness, Focus adverbs, It-clefts, Semantic violation