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CORRELATIVE CONJUNCTIONS AS SPACE BUILDERS: VIOLATION OF PARALLEL STRUCTURE OFFERS CORRELATIONAL SUPPORT FOR THE PSYCHOLOGICAL REALITY OF MENTAL SPACES

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Abstract. *The paper aims to explore how violations of parallel structure in English correlative conjunctions affect participants' response times (RTs) and accuracy ratings in an online incremental grammaticality judgment task, where correlative conjunctions are understood as space builders (i.e., each correlative conjunction is expected to yield a dual-space network). The study included 37 advanced EFL students from the University of Niš. The main experiment included 14 target sentences with 7 different correlative conjunctions, with the second part of a correlative conjunction missing. Stimuli were presented word-by-word, with a mask, in a self-paced moving windows paradigm. The relevant independent variables recorded in Open Sesame were RTs and response accuracy. The obtained results show increased RTs associated with error positions. Specifically, the analysis of the overall mean tendency across all items and over the entire sample showed significantly higher mean RTs in the error position compared to RTs in accurate sentence positions ($p<.001$). Moreover, the analysis of overall accuracy showed a significantly higher mean value of accurate responses for correct sentence parts compared to the sentence parts with an error ($p=.006$), and a significantly lower mean value of inaccurate responses in correct sentence parts compared to parts of sentences with errors ($p=.015$). By-item analyses showed higher counts of accurate responses in error positions, which also reached significance in most cases. The obtained results offer correlational support for the psychological reality of parallel structure and mental spaces.*

Key words: *correlative conjunctions, parallel structure, mental spaces, space builders, reaction times, Open Sesame*

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1. INTRODUCTION

The present paper explores the issue of psychological reality of parallel structure and mental spaces by analyzing participants' reaction times (RTs) and response accuracy in an online incremental grammaticality judgment task. Namely, the main experiment included 7 different correlative conjunctions, where the violation of parallel structure was reflected in the omission of the second part of the conjunction. We expect that such violations of the grammatical template will be associated with increased RTs in error positions, and that the lag in RTs will, in turn, reveal at least a certain degree of *noise* in the ratio of accurate/inaccurate responses either in, or near the error position. Additionally, such violations of parallel structure are expected to halt the construction of dual-space networks.

2. THEORETICAL FRAMEWORK

2.1. Correlative conjunctions and the structure of coordination

Correlative conjunctions reflect parallel structure, i.e., the structure of coordination, insofar as they are used to connect elements of equal syntactic status (e.g., Quirk et al. 1985, 940; Pollock 1997, 56; Greenbaum and Nelson 2002, 55). Also referred to as *paired conjunctions*, they consist of two elements, and they include pairs like: *both … and, not only … but also,* etc. (Quirk et al. 1985, 935–940; Pollock 1997 56–67). In broader terms, "the structure of coordination is the relationship of linking linguistic units of equivalent syntactic status (same syntactic function) by means of a coordinating conjunction" (Mišić-Ilić 2008, 61). Also, parallel structure is typically used "to show proper relationships between similar or related ideas" (Pollock 1997, 48). Greenbaum and Quirk (1990, 271–280) emphasize the distinction between *simple* and complex *coordination*. With the former, "a single clause or clause constituent is linked to others that are parallel in meaning, in function, and (generally) in form" (Greenbaum and Quirk 1990, 271), whereas with the latter, the coordinated units consist of combinations of multiple elements, which enhances the parallelism between such units (Greenbaum and Quirk 1990, 278).

Parallel structure is prototypically reflected through coordinating conjunctions that can be used to connect *individual words, phrases, clauses,* or *sentences* (Pollock 1997, 48–55), and some typical coordinating conjunctions include connectors such as *and, but, nor, yet,* etc. (Quirk et al. 1985, 930–935; Lester 2008, 284). Apart from performing the role of logical connectors, they also have a marked grammatical function, insofar as they are used to connect elements of equal grammatical 'value' (Greenbaum and Nelson 2002, 155). Violations of this rule lead to *faulty parallelism*, where the coordinated elements are no longer syntactically equivalent (Lester 2008, 275–280; Greenbaum and Nelson 2002, 155–156). An important distinction is made between *syndetic, asyndetic*, and *polysyndetic* coordination (Greenbaum and Quirk 1990, 262). Namely, syndetic coordination is marked by the presence of an explicit coordinating conjunction; asyndetic coordination is marked by the absence of an explicit coordinator; while polysyndetic coordination is characterized by the repetition of a coordinator between each pair of coordinated elements (Greenbaum and Quirk 1990, 262). Finally, coordinating conjunctions "may be reinforced by correlative expressions" (Greenbaum and Nelson 2002, 55), where the latter can serve to emphasize the rhetorical effect of the former.

2.2. Correlative conjunctions as space-builders

Gilles Fauconnier (e.g., Fauconnier 1981, 1994[1985], 1997, 2007) introduced the concept of a *mental space* in an attempt to capture the dynamic nature of meaning construction that is typically predominantly based on the development of connections and correspondences between multiple domains. Structured by *semantic frames* (Fillmore 1982) or *idealized cognitive models* (ICMs, Lakoff 1987), mental spaces are not limited to linguistic exchanges between interlocutors, but actually enable us to navigate the everyday reality by facilitating the process of meaning construction in the broadest sense (Fauconnier 1994[1985]). A semantic frame here is understood as "any system of concepts related in such a way that to understand any one of them you have to understand the whole structure in which it fits; when one of the things in such a structure is introduced into a text, or into a conversation, all of the others are automatically made available" (Fillmore 1982, 111). ICMs, on the other hand, pose as complex gestalts used to organize background knowledge, and "category structures and prototype effects are by-products of that organization" (Lakoff 1987, 68). In turn, mental spaces will necessarily reflect the encyclopedic view of meaning, where individual lexical items are understood as access points to vaster repositories of background knowledge (Langacker 1987, 173).

Fauconnier (1994[1985], 16) defined mental spaces as "constructs distinct from linguistic structure but built up in any discourse according to guidelines provided by the linguistic expressions." Individual words (or phrases) can serve as triggers that afford the construction of a mental space – i.e., they constitute *space-builders*. Namely, "a space-builder is a grammatical expression that either opens up a new space or shifts focus to an existing space" (Fauconnier 1997, 40). Some typical space-builders include prepositional phrases (e.g., in that picture), adverbs (e.g., probably, possibly), connectives (e.g., either … or, if … then), and underlying subject-verb combinations (e.g., he believes, she hopes) (Fauconnier 1997, 17).

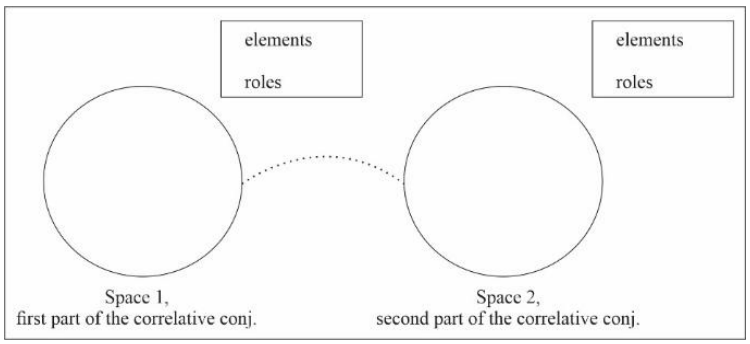

Fig. 1 Correlative conjunctions as space-builders

In plain terms, based on the situational and linguistic context, and specific space-builders, the activated "frame-level structure undergoes some sort of *contextual filtering*, which gives way to its partial equivalent in the form of a mental space" (Figar 2021, 127). As discourse unfolds, mental spaces afford the construction of a *discourse lattice* which constitutes a series of "structured, incremental sets […] with elements […] and relations holding between them [so] that new elements can be added to them and new relations established between their elements" (Fauconnier 1994[1985], 16). In some specific cases,

mental spaces can interact and afford new, *blended* mental spaces with novel emergent structures not present in either of the original mental spaces (Fauconnier and Turner 2000; 2002). The interaction takes place at the level of organizing frames of the original spaces, and the process is called *conceptual blending*[1] (e.g., Fauconnier and Turner 2000; 2002; Coulson and Oakley 2005).

In the context of the present paper, we treat correlative conjunctions as space-builders expected to activate an entrenched pattern of a dual-space network (Figure 1), where the first part of the correlative conjunction activates the first space, in turn creating the expectancy, i.e., priming the reader (in the sense of Branigan et al. 1995), for the construction of the second space. Absence of the second part of the correlative conjunction is expected to produce a delay in the construction of such dual-space networks, which should correlate with a lag in response times (RTs) in the main experimental task (see section 4 below). In other words, the introduction of the first part of the correlative conjunction should be followed by its second part via the mechanism of *pattern completion* (in the sense of Barsalou 2009, 1282, and Fauconnier and Turner 2002, 48). If the second part is omitted, there should be a delay caused by the violation of parallel structure. In effect, the abstract pattern of parallel structure discussed above should correlate with the construction of a dual-space network; this, in turn, is expected to afford a certain degree of correlational evidence in favor of the psychological reality of both phenomena.

3. Previous Research in Psycholinguistics

Frazier, Munn, and Clifton (2000) conducted four experiments in which they tested the main constraints that affect the processing of parallel structure. Their hypothesis was that the processing of a target syntactic structure is facilitated in contexts where it was preceded by a similar syntactic structure. The data obtained in the experiments showed that the presence of the structure of coordination facilitates processing "even in sentences which are fully acceptable in the absence of syntactic parallelism" (Frazier, Munn, and Clifton 2000, 345).

In Experiment 1 the researchers examined the processing of sentences where the conjuncts varied in syntactic category, but were similar in terms of semantic types (e.g., *carefully (Adv)* and *with great care (PP)*, where both target items denote manner). The experimental setup involved eye tracking methodology, and the relevant dependent variables were *first-pass reading time, total reading time,* and *response accuracy.* The results showed that similar syntactic categories facilitated the processing of target stimuli, and this was most likely "due to facilitation in processing parallel structures" (Frazier, Munn, and Clifton 2000, 349). In Experiment 2, all target stimuli represented the same semantic category, i.e., "predicates that assign a property to an individual" (Frazier, Munn, and Clifton 2000, 350). The experimental setup involved a self-paced reading task, where complete sentences were presented to participants. These were then followed by wh-questions which participants answered out loud. The relevant dependent variables were *reading times* and *response accuracy*. The obtained results showed that syntactic parallelism facilitated the reading of the second conjunct, whereas semantic parallelism alone failed to produce such an effect (Frazier, Munn, and Clifton 2000, 352).

Experiment 3 was designed to test the possible effects "of syntactic parallelism in the processing of conjuncts whose internal structure is or is not syntactically parallel" (Frazier, Munn, and Clifton 2000, 352). This experiment also involved an eye tracking paradigm,

[1] Being beyond the scope of the present paper, for more details the reader is referred to some of the original references dealing with conceptual blending (e.g., Fauconnier and Turner 2002; Coulson and Oakley 2005).

and it was conducted together with the first experiment, following similar experimental procedures. The results showed significantly longer reading times for the second part of the coordinated structure when it was syntactically different from the first part, compared to conditions where the two coordinated structures were syntactically similar (Frazier, Munn, and Clifton 2000, 354).

Hoex, Vonk, and Schriefers (2002) explored differences in the processing of the NP-coordination (where objects of the verb are coordinated), and S-coordination (which involves the conjoining of sentences) in various contexts, where target sentences were presented within contextualized stories. Experiment 2 utilized a self-paced reading paradigm, where Hoex, Vonk, and Schriefers (2002, 105) aimed to explore whether manipulations of topic structure could "eliminate the processing difficulty observed in temporarily ambiguous S-coordination presented without a context." Each target sentence experiment was presented in two types of contexts: a neutral and a biasing context. It was expected that the use of neutral contexts with no clues that would hint at the topic structure of the forthcoming sentence "would provide the strongest test of the principle of minimal topic structure" (Hoex, Vonk, and Schriefers 2002, 106). The results showed processing difficulties for temporarily ambiguous S-coordinations presented in neutral contexts (Hoex, Vonk, and Schriefers 2002, 110). Additionally, "topic manipulation in the biasing context eliminated this processing difficulty [which supports the idea] of the NP-coordination preference in terms of topic-structure simplicity" (Hoex, Vonk, and Schriefers 2002, 110–111).

Figar (2018) tested the notion of the psychological reality of parallel structure with advanced Serbian EFL students. The experiment involved a reaction time study with grammaticality judgments, while the experimental materials included different examples of faulty parallelism in sentences containing the correlative conjunction *not only ... but also*. Sentences were presented to participants in a moving window paradigm, word-by-word, with a mask (Figar 2018, 45). The results showed processing difficulties manifested through increased response times in the error positions in most cases, and the comparisons showed statistically significant delays compared to response times in the adjacent, correct, positions in target sentences (Figar 2018, 61). Figar (2018, 61) concluded that the recorded lags in response times were most likely due to "the violation of expectancies generated by the abstract generalized pattern of parallel structure." In turn, such findings offer support for the notion of the psychological reality of parallel structure.

4. Present Research: Aims and Research Questions

The paper explores the psychological reality of parallel structure utilizing a moving windows paradigm (as outlined in Blackwell, Bates, and Fisher 1996), coupled with a reaction time (RT) study. The relevant dependent variables recorded in Open Sesame (Mathôt and Theeuwes 2012) were RTs (in milliseconds) and response accuracy. The experiment was designed to provide answers to the following research questions:

i. Are violations of parallel structure reflected in participants' RTs to target stimuli?
ii. How did violations of parallel structure affect participants' accuracy ratings?
iii. Can the obtained results be used to offer support for the notion of the psychological reality of parallel structure and mental spaces?

4.1. Participants, stimuli, and methodology

37 advanced second-year EFL students from the English Department, Faculty of Philosophy, University of Niš, volunteered to take part in the study. There were 22 female and 15 male participants, with the average age of 20.14 (SD=0.73). The obtained results were first screened for outliers and all RTs longer or shorter than two standard deviations were excluded from the analysis (in line with Hoex, Vonk, and Schriefers 2002, 109). Two participants failed to complete the experiment and were excluded from further analyses.

Stimuli used in the experiment were compiled based on students' errors recorded in their *Contemporary English 3* exams in the period 2014–2018. Namely, each of the stimuli (sentences) contained an error reflecting the violation of parallel structure where the second part of the correlative conjunction was missing (Table 1). Specifically, we tested the following correlative conjunctions: *hardly ... when* (sentences 1 and 14), *no sooner ... than* (sentences 2 and 13), *scarcely ... when* (sentences 3 and 12), *not only ... but also* (sentences 4 and 11), *both ... and* (sentences 5 and 8), *either ... or* (sentences 6 and 10), and *neither ... nor* (sentences 7 and 9).

Table 1 Experimental stimuli

No.	Stimulus
1.	Hardly had Jack gone to bed *the phone rang.
2.	No sooner had Sarah returned home *she got called back to work.
3.	Scarcely had Tom entered the building *there was a loud explosion.
4.	Not only does Susan play the piano *she plays the flute.
5.	Both Jack *Jim are good at Physics.
6.	Either Peter *his wife is going to buy the groceries.
7.	Neither Jack *Susan knows the answer to the question.
8.	Both Jack *Sarah like going to the cinema.
9.	Neither John's friend *John plans to go on holiday.
10.	Either you go home *you can sleep on the couch.
11.	Not only is John rich *he is very handsome.
12.	Scarcely had the burglar entered the apartment *the alarm went off.
13.	No sooner had the surgeon come to work *a gunshot victim was brought in.
14.	Hardly had the concert started *the power went off.

Based on the theoretical framework and previous research, the onset of the first part of a correlative conjunction was expected to trigger the grammatical pattern of parallel structure, thereby producing the expectancy that the second element was to follow in the appropriate 'slot'. In other words, the initial element of a paired conjunction should prime the participants for the second element which should be recruited via *pattern completion*, thereby completing the dual-space network. In effect, if participants have acquired the grammatical pattern, it should be recruited automatically and violations of the pattern should cause a lag in RTs. Furthermore, if the pattern has been acquired, participants' accuracy ratings should not be affected by the potential lag in RTs that we predicted.

The experiment included a practice loop with 4 sentences, after which participants proceeded to the main experiment. Stimuli were presented with a mask on a 15.6" screen of a Toshiba Satellite C55 laptop. Participants were instructed to decide as quickly as possible whether the sentence was grammatically correct or not after each new segment of the sentence had appeared on the screen. Participants' RTs were measured from the onset

of the target to their accuracy rating. The position of accurate/inaccurate responses was counterbalanced between the ”A” and “L” keys on the keyboard, and the order of stimuli was randomized across participants.

4.2. Analysis and results: RTs and accuracy

One-way repeated measures ANOVA was used to compare the mean RTs in the error position to the overall mean RTs in accurate positions, and the obtained results are presented in Table 2. By-item comparisons revealed significant differences in RTs in favor of error positions in most cases, except for sentences 2, 4, 6, 10, and 13. However, despite the lack of significance in all cases comparisons of means still revealed a consistent lag in RTs in the error positions. Such results can be attributed to the violation of the pattern of parallel structure, which in turn caused a violation of expectancies with our participants. In other words, initial elements of correlative conjunctions seem to have primed the participants for the appropriate pattern, but the omission of the second element in the expected position caused a delay in their decision-making process. This, in turn, can be associated with the omission of a specific *space builder* (i.e., the second part of the correlative conjunction), which halted the construction of a dual-space network.

Table 2 Comparison of RTs

Sentence No.	Accurate positions – overall RT [ms]		Error position RT [ms]		p	Multivariate partial η^2
	M	SD	M	SD		
1.	690.07	263.42	899.63	381.84	.017	.28
2.	640.04	175.60	927.38	675.00	.126	.18
3.	630.97	129.71	1277.21	1057.37	.034	.30
4.	621.84	161.57	741.00	466.81	.301	.07
5.	658.09	150.98	1151.00	542.53	.002	.49
6.	753.20	186.99	990.67	532.71	.141	.19
7.	642.46	205.09	1065.43	491.05	.003	.50
8.	637.78	189.10	951.81	328.83	.002	.47
9.	787.43	153.51	1130.14	424.70	.006	.45
10.	734.10	160.69	806.88	291.22	.436	.09
11.	676.28	181.24	1333.00	748.92	.035	.45
12.	714.13	162.57	1061.75	519.66	.047	.31
13.	672.72	187.54	883.67	493.89	.145	.18
14.	630.18	192.37	1140.76	805.30	.012	.33

An additional one-way repeated measures ANOVA was performed to compare the overall means of RTs in accurate sentence positions and positions containing the error in all sentences (Figure). The results showed significantly lower RTs in accurate positions compared to the error position ($F(1,13)=52.40$, $p<.001$, multivariate partial eta squared=.80, Wilks' Lambda=.20, $M_{accurate}=677.81$ ms, $SD_{accurate}=51.61$ ms, $M_{error}=1025.74$ ms, $SD_{error}=171.37$ ms).

It is also worth noting that in seven cases (sentences 4–10) we also recorded a *spillover effect*, where the lag in RT was prolonged from the error position either to the subsequent position (sentences 4, 5, 7, 8, and 9), or to two subsequent positions (sentences 6 and 10).

Sentences 5 and 8 contain the correlative *both ... and*, and the error is located in the 3rd position in both cases, i.e., at the onset of the sentence. In effect, the spillover from the

error position to the subsequent position can be, at least in part, attributed to the position of the error in relation to the overall sentence context. In other words, the participants found it difficult to make a grammaticality judgment without sufficient context. The recorded lag in RT did not cause any notable increases in the number of incorrect responses. Moreover, the difference between accurate and inaccurate responses in the error position reached significance in favor of the former, in both sentences ($\text{Chi-square}_{\text{sentence5}}=6.43$, $p_{\text{sentence5}}=.011$, $\text{Chi-square}_{\text{sentence8}}=15.11$, $p_{\text{sentence8}}<.0001$).

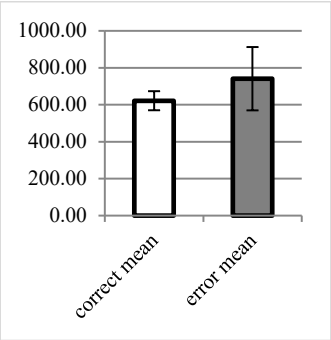

Fig. 1 RTs overall

A similar explanation can be offered for sentence 7 with the correlative *neither ... nor*, where the error is again located in the third position. In sentence 9, however, with the same correlative, the error is located in the middle of the sentence; however, the content of the sentence in this case can easily lead to semantic ambiguity. Namely, the second occurrence of the subject (*John*) can be easily mistaken for the name of *John's friend* (*Neither John's friend *John plans to go on holiday*). In that case, based on the available context, the subjects could have just as well 'predicted' the following structure: *Neither John's friend John, nor John himself* etc. In effect, the recorded spillover can be attributed to the identified semantic ambiguity.

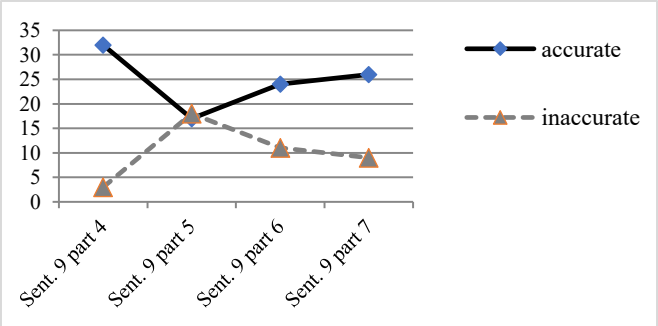

Fig. 2 Sentence 9 accuracy

The recorded delay in sentence 9 also affected participants' accuracy ratings (Figure 2); namely, the results showed an increase in the number of inaccurate responses in the 5th

position, right after the error. However, the number of inaccurate responses in the error position was significantly lower compared to the number of inaccurate responses (Chi-square=24.03, p<.001).

In sentence 4, with the correlative *not only … but also*, the error is located in the second half of the sentence (8th position). One possible explanation of the recorded spillover effect can be attributed to the expected position of the error. Namely, instead of the expected error position (*Not only does Susan play the piano *she plays the flute*), some participants might have opted for a variation in which the second half of the correlative is 'split apart', and the sentence would read: "**but she plays the flute *also*," thereby 'moving' the second element (*also*) to the final position. As a result, the recorded lag can be understood as a result of this strategy.

The analysis of accuracy also showed a change in the ratio of accurate/inaccurate responses between positions 8 and 10 (Figure), suggesting that the recorded lag was also coupled with an increased number of inaccurate responses. The number of accurate responses in the error positions was again significantly higher than the number of inaccurate responses (Chi-square=12.06, p<.001).

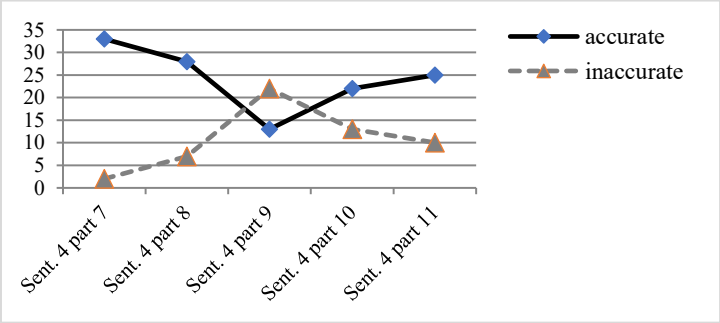

Fig. 3 Sentence 4 accuracy

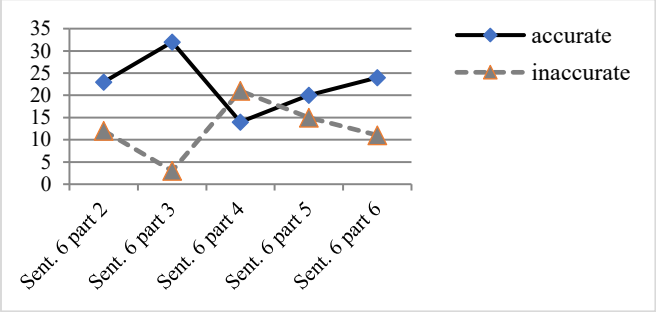

Fig. 4 Sentence 6 accuracy

Sentences 6 and 10, with the correlative *either … or*, showed a prolonged spillover effect. In sentence 6, the error is located in the third position, and the recorded effect reflects the tendency already recorded in sentences 5, 7, and 8. The spillover is also connected to the decrease in the number of accurate responses in the spillover positions (Figure), which

shows that processing difficulties did not only cause a lag in RT, but also affected accuracy ratings. It is important to note that the number of inaccurate responses in the error position was significantly lower than accurate ones (Chi-square=24.03, p<.0001).

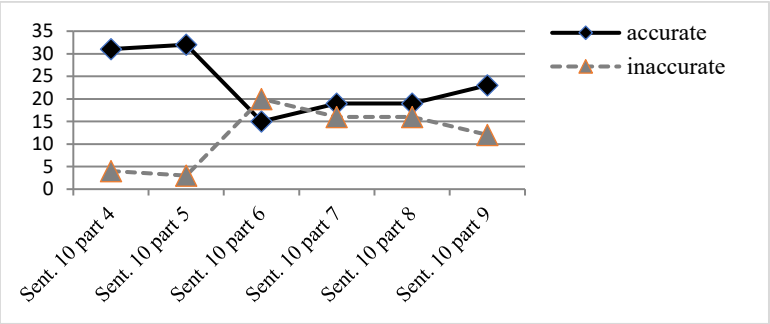

Fig. 5 Sentence 10 accuracy

In sentence 10, the error is located in the middle of the sentence and the lag in RTs is somewhat confusing. Namely, the initial segment (*Either you go home *you can sleep on the couch*) should have provided sufficient context for the error to be identified; however, there was some processing difficulty which, based on the obtained results and the already identified extended spillover in sentence 7 with the same correlative conjunction, can be attributed to the conjunction itself. In other words, processing difficulty suggests that the participants might have had difficulties in interpreting the semantic content. Moreover, the recorded accuracy (Figure) shows that the ratio of accurate/inaccurate responses suddenly changes between position 5 containing the error, and the subsequent two positions. In turn, the recorded spillover is also evident in the increased number of inaccurate responses. Still, the number of incorrect responses in the error position was significantly lower than the number of accurate ones (Chi-square=24.03, p<.0001).

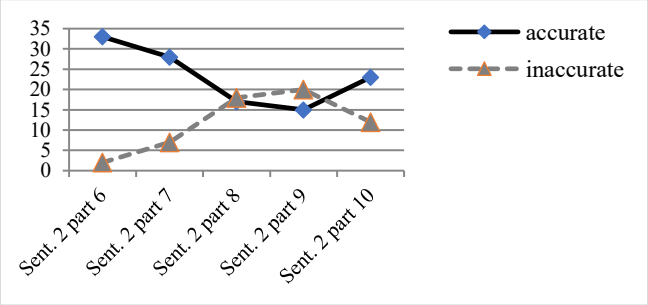

Fig. 6 Sentence 2 accuracy

Although spillover effects were not recorded, in sentences 2, 3, 12, and 13 there was a notable increase of inaccurate responses *indirectly* associated with the error position. Sentence 14 did not show any notable offset in the ratio of accurate/inaccurate responses

following the error. Also, the difference between accurate and inaccurate responses in the error position did not reach significance for this sentence (Chi-square=2.31, p=.128).

In sentence 2 with the error in the 7th position, the number of inaccurate responses suddenly increased after the error, suggesting that although a spillover effect was not recorded, the lag in RT in the error position did in fact have a detrimental effect on response accuracy in the subsequent positions. Importantly, the number of accurate responses in the error position remained significantly higher compared to inaccurate responses (Chi-square=12.60, p<.0001).

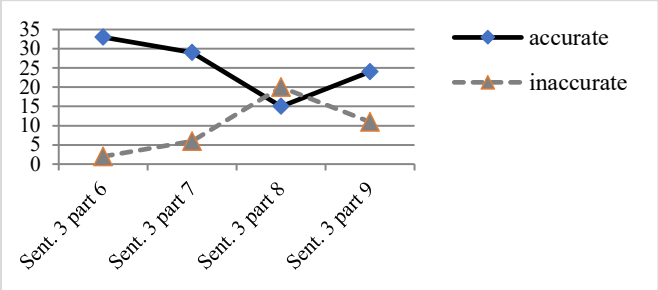

Fig. 7 Sentence 3 accuracy

A similar result was recorded in sentences 3 and 12, where again, despite the lack of spillover, there was a drop in the number of accurate responses right after the error position, i.e., in the 8th and 9th position, respectively (Figures). Comparison of accurate and inaccurate responses showed a significantly lower number of inaccurate ones both in sentence 3 (Chi-square=15.11, p<.0001), and in sentence 12 (Chi-square=8.26, p=.004).

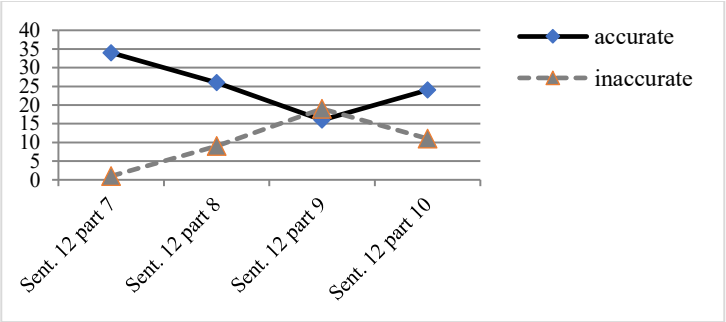

Fig. 8 Sentence 12 accuracy

With sentence 13, there was a decrease in the number of accurate responses recorded in the two positions preceding the error (positions 7 and 8), as well as in the error position itself, while the subsequent positions show an increase in the number of accurate responses (Figure). The difference in the number of accurate and inaccurate responses in the error position did not reach significance ($\text{Chi-square}_{\text{position } 9}$=2.31, p_9=.128), while in the subsequent two positions the number of accurate responses was significantly higher ($\text{Chi-square}_{\text{position } 10}$=8.26, p_{10}=.004, $\text{Chi-square}_{\text{position } 11}$=10.31, p_{11}=.001).

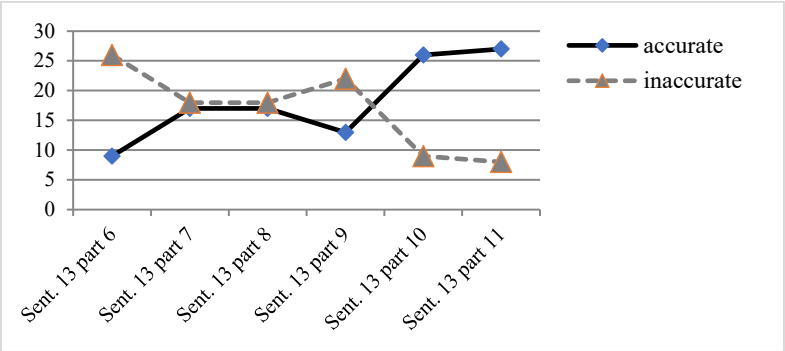

Fig. 9 Sentence 13 accuracy

In summary, correlatives *both ... and, either ... or,* and *neither ... nor* have caused the most difficulties in the incremental grammaticality judgment task which was reflected in the recorded spillover effects; *not only ... but also* showed spillover as well, but only in one case. Additionally, spillover effects were coupled with an increase in the number of inaccurate responses in positions following the error. Apart from sentences with spillover effects, a number of the remaining stimuli also showed an increased number of inaccurate responses that can be (indirectly) attributed to the errors.

4.3. Analysis and results: Overall accuracy

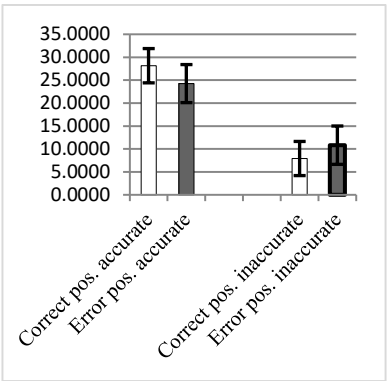

Fig. 10 Overall accuracy

The accuracy of participants' responses was recorded for each sentence position in all stimuli. Based on the obtained data, we (i) first calculated the means for accurate and inaccurate responses for sentence parts that were correct in each individual sentence, and (ii) then the values for accurate and inaccurate responses for sentence parts that contained the error (also for each sentence). For sentences where spillover in RTs had been identified, we treated the spillover positions as extended error positions; consequently, for these cases means for accurate and inaccurate responses in the error and the extended error positions were also calculated. Based on

these data, we finally calculated (i) the overall mean tendency for accurate and inaccurate responses for correct sentence parts in all sentences, and (ii) the overall mean tendency for accurate and inaccurate responses in sentence parts containing an error (Figure 10).

One-way repeated measures ANOVA showed a significantly higher mean value of accurate responses for correct sentence parts compared to the sentence parts containing an error ($F(1,13)=10.57$, $p=.006$, multivariate partial eta squared=.45, Wilks' Lambda=.55, $M_{correct}=28.16$, $SD_{correct}=3.73$, $M_{error=24.25}$, $SD_{error}=4.15$). The same test, on the other hand, revealed a significantly lower mean value of inaccurate responses in correct sentence parts compared to parts of sentences with errors ($F(1,13)=7.78$, $p=.015$, multivariate partial eta squared=.37, Wilks' Lambda=.63, $M_{correct}=7.91$, $SD_{correct}=3.72$, $M_{error}=10.82$, $SD_{error}=4.18$). In summary, the obtained results again show that processing difficulties already identified in terms of increased RTs are also reflected in participants' overall response accuracy, which can be generalized for all items and over the entire sample.

4.4. Analysis and results: Mental spaces

The structural blueprint afforded by parallel structure works in concert with the construction of mental representations corresponding to the lexical-semantic content of each sentence. In other words, while the first parts of correlative conjunctions prime the reader for the activation of the proposed dual-space network, additional linguistic prompts enable the integration of specific conceptual structures into each space. For instance, in Sentence 1 (Figure 11), "hardly" sets up the scaffolding for a dual-space network, while the remainder of the sentence provides lexical-semantic content based on which specific elements and relations that hold between them are introduced into their respective mental spaces. Specifically, these mental spaces describe the subject, *Jack, going to bed*, followed by the subsequent *ringing of the phone*. The first mental space in Sentence 1 is organized by the "going to bed" frame, while the second space is organized by the "telephone ringing" frame.

The recorded significant delay in RT in the error position (Table 1 above) suggests that due to the omission of the second part of the correlative conjunction the participants not only deemed the sentence ungrammatical at this point, but also most likely experienced some difficulty with the construction of the second mental space. In turn, such results also seem to imply that there is an important connection between the activation of an abstract grammatical pattern of parallel structure, and the construction of conceptual content in the corresponding mental space networks.

Moreover, based on the obtained results, we argue that in this case priming is actually twofold: it works both at the structural and at the conceptual level; i.e., we can identify both syntactic and semantic priming that work in concert, thereby enabling the participants to assess the grammaticality of each sentence. While the first part of the correlative conjunction primes the reader for parallel structure, the lexical semantic content that prompts the construction of the first mental space builds the expectancy for subsequent semantic content that should be congruent (i.e., sensical in the given *optimal context* which marks *sentence-level context*, in the sense of Prćić 1997). With this in mind, the recorded delays in the error positions suggest that the missing parts of correlative conjunctions have most likely affected both the grammatical and semantic level of processing. Such results are in line with the main tenets of cognitive semantics and cognitive grammar, where grammar and conceptualization go hand in hand, rather than being separate processing modules (e.g., Langacker 1987; Evans and Green 2006).

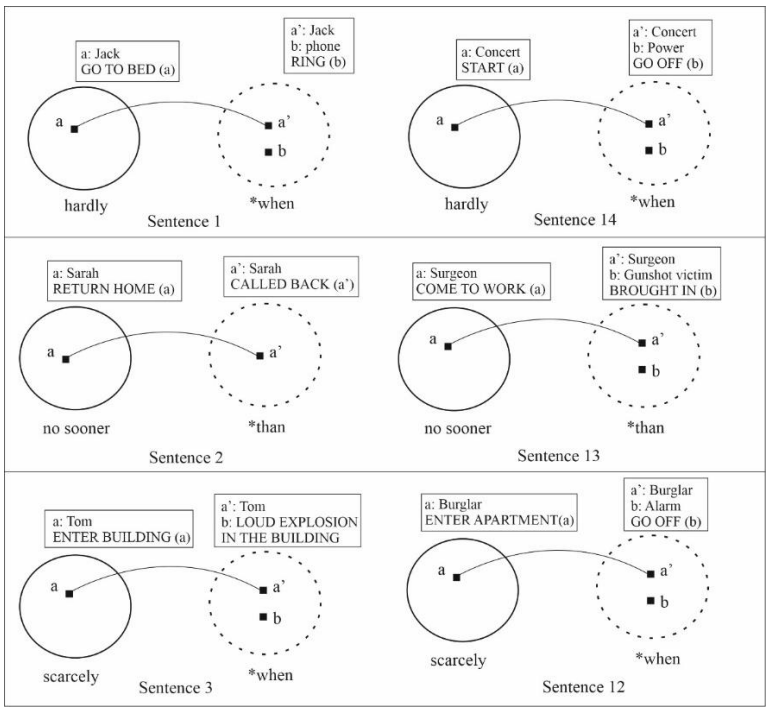

Fig. 11 Dual-space networks (sentences 1, 2, 3, 12, 13, and 14)

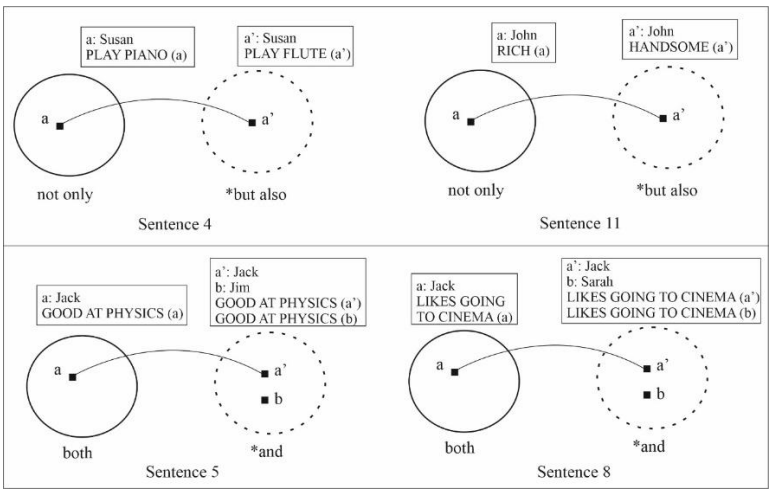

Fig. 12 Dual-space networks (sentences 4, 5, 8, and 11)

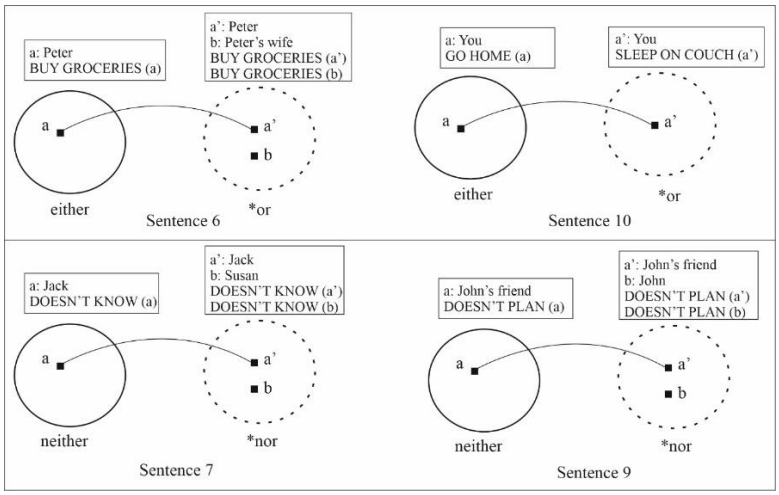

Fig. 13 Dual-space networks (sentences 6, 7, 9, and 10)

A similar line of reasoning can be applied to the remaining sentences, and the corresponding dual-space networks are given in Figures 12 and 13.

5. DISCUSSION

By-item analysis of mean RTs showed a consistent lag recorded in error positions compared to accurate sentence positions. Although the differences did not reach significance in all cases, the overview of means shows increased values in error positions for all stimuli. Furthermore, the comparison of overall means in error positions and accurate positions for all items and across the entire sample revealed significantly higher values in error positions ($p<.001$). Such results suggest that participants experienced processing difficulties associated with the violation of the pattern of parallel structure. In effect, increased RTs in error positions can be interpreted as correlates of these predicted processing difficulties, which in turn provides support for the idea that the abstract grammatical templates of parallel structure is indeed psychologically real.

Additionally, a number of sentences showed spillover effects linked to the error; namely, in sentences 5, 7, 8, and 9, spillover continued to the subsequent position, while in sentences 6 and 10 it continued onto two subsequent positions. In sentences 4, 5, 7, and 8, spillover can be attributed to the early error position (position 3), where participants did not have sufficient sentence context to provide a grammaticality judgment. In sentence 9, the spillover can be accounted for by the above discussed semantic ambiguity (*John's friend John*), where participants also required additional context to make the appropriate decision. With sentence 4, the recorded spillover was attributed to alternative construal that participants might have employed in the interpretation of the sentence, where the position of the error can be shifted to the sentence final position. The prolonged spillover in sentence 6 can be attributed to the early onset of the error (position 3, similar to sentences 5, 7, and 8). The unexpected prolonged lag recorded in sentence 10 remains ambiguous, and based on the obtained data it can most likely be accounted for by the specific correlative conjunction *either ... or*, which has caused a prolonged spillover in both sentence 6 and sentence 10.

Overall accuracy analysis showed a significantly higher mean value of accurate responses for correct sentence parts compared to the sentence parts containing an error (p=.006), and significantly lower means for inaccurate responses in correct sentence parts compared to parts of sentences with errors (p=.015). By-item analysis revealed consistently higher counts of accurate responses in error positions, which reached significance in all cases except sentences 13 and 14. Additionally, the results also show noise reflected in the predicted offset in the ratio of accurate and inaccurate responses; however, this was not associated directly to the error, but it occurred in subsequent positions. This suggests that the recorded lags in RTs, which in some cases even caused spillover effects, can also be associated with difficulties in accuracy ratings that were identified after the error position. This trend was also recorded in most of the sentences without RT spillover. This in turn suggests that even without significant increases in RT, the violation of the abstract pattern of parallel structure still introduces notable noise in terms of response accuracy. In sum, the predicted processing difficulties caused by the violation of parallel structure are reflected in terms of both increased RTs and increased numbers of inaccurate responses due to the noise following the error position.

In the context of mental spaces, correlative conjunctions can be understood as prompts for the construction of dual-space networks. In that sense, they yield expectancies that operate both at the structural and conceptual levels. The recorded delays in RTs associated with the error position reflect not only the violation of the abstract pattern of parallel structure, but also the difficulties in the construction of the second mental space in the dual-space network (since the explicit space builder in the form of the second part of a correlative conjunction was missing). In effect, bearing in mind the link between (i) the abstract structural patterns of parallel structure, on the one hand, and (ii) the conceptual, and semantic-pragmatic[2] contents presented through mental spaces (predominantly via participants, roles, optimal contexts, and pragmatic functions[3]), on the other, the obtained results can also be understood as (at least) correlational evidence in favor of the notion of the psychological reality of parallel structure and mental spaces.

Finally, it needs to be noted that the participants performed the experiment not in their mother tongue, but in English. Bearing in mind that the sample included advanced second year Serbian EFL students, the obtained results must be interpreted with an important caveat. Namely, the recorded data can be understood as an important indicator of the level of acquisition of the abstract pattern of parallel structure. In that sense, the recorded lags in RTs in error positions show that the participants have acquired the abstract pattern which entails the occurrence of a second part of a correlative conjunction once the first part has been introduced. In other words, the occurrence of the first part of a correlative conjunction is expected to facilitate the recruitment of the second part via pattern completion. Moreover, the recorded high level of response accuracy in the error position coupled with the lag in RTs shows that not only was the abstract pattern activated by the relevant syntactic and semantic context, but also the participants were able to utilize the acquired abstract pattern and make accurate grammaticality judgments. In effect, the obtained results can also be understood as a diagnostic tool that can be used to reveal the actual degree and quality of acquisition of abstract grammatical patterns.

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[2] Note that in the domain of cognitive semantics, the semantic and pragmatic levels of analysis are inherently connected, and meaning construction is always discussed in relation to specific contexts of language use (e.g., Langacker 1987; Fillmore 1982; Evans and Green 2006).

[3] In the sense of Fauconnier 1981; 1997.

6. Conclusions, Limitations, and Suggestions for Future Research

In conclusion, the obtained results offer correlational support for the idea of the psychological reality of parallel structure and mental spaces. Such a conclusion should increase the overall validity of the two theoretical models, inasmuch as the obtained results seem to show that they are not only useful analytical tools, but they also (at least to a certain extent) appear to reflect the way the human mind processes parallel structure and utilizes mental representations (in the form of mental spaces) in the process. Moreover, the results also appear to offer further empirical evidence in favor of the (apparently) inherent link between the abstract structural patterns, on the one hand, and conceptual structure, on the other – one of the cornerstone ideas of cognitive semantics (e.g., Evans and Green 2006).

Still, the present research can be expanded so as to include more participants, and a larger number of targeted examples of violations of parallel structure. Also, it would be useful to compare possible differences between EFL students and native speakers of English. In the context of EFL classrooms, such an experimental procedure can also be used as an objective assessment of the actual degree of acquisition of abstract grammatical patterns.

In all, the results obtained in the present study offer a promising starting point for future explorations of the notion of the psychological reality of parallel structure and mental spaces. In turn, such line of investigation would contribute greatly to the convergent validity of the obtained data.

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KORELACIONI VEZNICI I IZGRADNJA MENTALNIH PROSTORA: NARUŠAVANJE KOORDINISANIH STRUKTURA NUDI KORELACIONE DOKAZE U KORIST PSIHOLOŠKE REALNOSTI MENTALNIH PROSTORA

Cilj istraživanja je da utvrdi kako narušavanje koordinisanih struktura kod korelacionih veznika u engleskom jeziku utiče na brzinu reakcije i tačnost odgovora ispitanika prilikom ocene gramatičnosti ciljnih rečenica. Korelativni veznici se dovode u vezu sa izgradnjom mentalnih prostora. U glavnom eksperimentu, ciljne draži predstavljane su reč-po-reč, kroz paradigmu pokretnih ekrana, a ispitanici su imali zadatak da nakon uvođenja svake nove reči ocene gramatičnost rečenice u datom trenutku. Rezultati su pokazali duže vreme reakcije u pozicijama na kojima se nalazila greška, a razlika je dostigla i statističku značajnost (p<.001). Analizom tačnosti odgovora utvrđen je takođe značajno veći broj tačno ocenjenih grešaka u ciljnim pozicijama. Dobijeni rezultati nude korelacione dokaze u korist psihološke realnosti koordinisanih struktura i mentalnih prostora.

Ključne reči: *korelacioni veznici, koordinisane strukture, mentalni prostori, izgradnja mentalnih prostora, vreme reakcije, Open Sesame*