

How Adaptive is Linguistic Prediction?

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Language processing is known to be adaptive. For example, frequency of exposure to otherwise dispreferred syntactic structures can result in reduced processing costs for these structures over time, whereas more canonical syntactic structures become gradually dispreferred [1]. Crucially, this notion of adaptiveness has been extended to predictive processing [2,3], the rationale being that comprehenders are able to adapt their predictions depending on the likelihood that they will be fulfilled: Conditions which near-always meet linguistic predictions (i.e., high-validity conditions) should encourage comprehenders to continuously generate predictions, whereas conditions which disconfirm predictions frequently (i.e., low-validity conditions) should result in attenuated predictive processing. Unfortunately, however, to date there is rather mixed evidence on this claim. Whereas some studies support the idea that predictive processing is inherently adaptive [4,5,6], other studies have challenged these conclusions [7], or shown with new experimentation that adaptiveness of predictions is not supported by current psycholinguistic evidence [8].

However, a weakness of previous studies is that they manipulated adaptiveness of predictions by means of between-subject designs, such that subjects were either allocated to the high-or the low-validity conditions (but not both), resulting in low explanatory power and allowing for the possibility that between-subject individual differences confound the results. In addition, nearly all previous studies on prediction adaptation were likely underpowered, due to the inclusion of small sample sizes.

In this planned work, I will re-examine the adaptiveness of linguistic prediction by overcoming some of these limitations. First, I will use a within-subject design. Second, I will recruit a large sample of subjects, to be determined by power analyses. Third, I will explicitly take into account subject-related individual differences by measuring, for each participant, their performance in tests of working memory, inhibitory control and lexical-semantic abilities. Figure 1 illustrates the design of the experiment, which is split in two self-paced reading (SPR) blocks a 48 sentences each, separated from one another by means of the individual difference tests. Each SPR block consists of a training phrase and a test phase. In the training phase (32 items total), I train participants to rely or not rely on linguistic predictions, by presenting them with a large proportion of prediction-confirming or disconfirming- sentences (75% vs 25%, respectively; see figure caption for an example). In the subsequent test phase (16 items total), I measure predictability effects for equal proportions of predictable and unpredictable sentences.

I expect to find two critical effects. First, a predictability * trial interaction in the training blocks, suggesting that predictability effects become larger (or smaller) with repeated exposure to predictable (or unpredictable) sentences. Second, I expect to find a predictability * validity interaction in the test blocks, suggesting that predictability effects are larger (smaller) after high- (low-) validity training. The results of this study will be of interest to researchers who work on predictive processing and those who study adaptiveness of (linguistic) behavior.

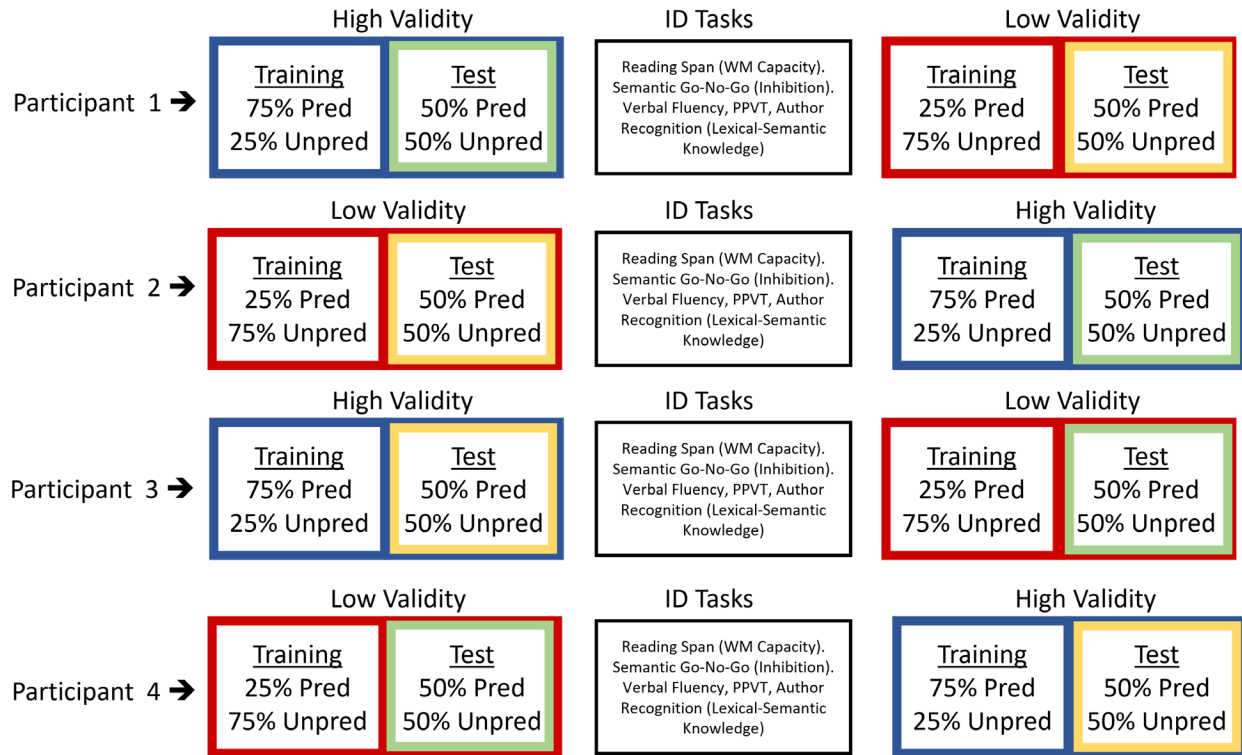


Figure 1

Experimental design. High- and low-validity blocks are marked in blue and red. The order of encountering high vs low-validity blocks first is counterbalanced over subjects, eliminating order effects. Green and yellow squares indicate different sets of test items which are crossed over validity and order sets, eliminating possible confounds related to presenting single items only in high- or low-validity conditions. Note that the training-test structure of the experiment is entirely implicit. From the perspective of the subjects, they simply read 48 sentences in one block without breaks or any other explicit or implicit indications of the training or test phase. An example of an experimental sentence is, (German original), "Als sie im Urlaub auf Mallorca waren, suchten Leo und Maja nach schönen Muscheln am StrandPredictable / StegUnpredictable vor ihrer Ferienwohnung". Planned statistical analyses include LMER models on predictable/unpredictable nouns and the three-word spill-over region, with individual difference measures entered as interaction variables.

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