



Effect of repetition proportion on language-driven anticipatory eye movements



Allison E. Britt^{a,*}, Daniel Mirman^a, Sergey A. Kornilov^{b,c}, James S. Magnuson^{b,c}

^a Moss Rehabilitation Research Institute, Elkins Park, PA 19027, USA

^b Department of Psychology, University of Connecticut, Storrs, CT 06269, USA

^c Haskins Laboratories, New Haven, CT 06511, USA

ARTICLE INFO

Article history:

Received 6 May 2013

Received in revised form 28 August 2013

Accepted 4 October 2013

Available online 15 December 2013

PsycINFO classification:

2343 Learning & Memory

Keywords:

Anticipation

Spoken-word comprehension

Repetition priming

Eye-tracking

ABSTRACT

Previous masked priming research in word recognition has demonstrated that repetition priming is influenced by experiment-wise information structure, such as proportion of target repetition. Research using naturalistic tasks and eye-tracking has shown that people use linguistic knowledge to anticipate upcoming words. We examined whether the proportion of target repetition within an experiment can have a similar effect on anticipatory eye movements. We used a word-to-picture matching task (i.e., the visual world paradigm) with target repetition proportion carefully controlled. Participants' eye movements were tracked starting when the pictures appeared, one second prior to the onset of the target word. Targets repeated from the previous trial were fixated more than other items during this preview period when target repetition proportion was high and less than other items when target repetition proportion was low. These results indicate that linguistic anticipation can be driven by short-term within-experiment trial structure, with implications for the generalization of priming effects, the bases of anticipatory eye movements, and experiment design.

© 2013 Published by Elsevier B.V.

1. Introduction

Learning regularities in the environment is a critical aspect of perception and cognition, especially in the domain of language processing. Studies on this topic have typically examined either participants' long-term knowledge of the regularities in their language and in the world more generally, or participants' learning of experimentally-constructed regularities within a controlled laboratory setting. Together, these lines of research have revealed that regularities are learned quickly and play an important role in online language processing. In this report we first briefly review these two lines of research and related findings on how within-experiment regularities affect priming. We then present an eye-tracking study that used an implicit measure (eye fixations) in a naturalistic task (word-to-picture matching, i.e., the "visual world paradigm" (Tanenhaus, Spivey-Knowlton, Eberhard, & Sedivy, 1995) applied to spoken word recognition (Allopenna, Magnuson, & Tanenhaus, 1998)) to examine how within-experiment regularities influence the dynamics of spoken word comprehension. The results demonstrated that within-experiment regularities produce the same kind of anticipatory effects that arise from regularities in language and the world at large.

1.1. Knowledge of regularities in language and the world

Anticipation is a crucial aspect of spoken language processing (for a review see Altmann & Mirković, 2009) and knowledge of regularities serves as a basis for anticipation. Eye-tracking provides a useful method for studying anticipation based on semantic, syntactic, and pragmatic factors. For example, Altmann and Kamide (1999) showed that listeners were more likely to look at a picture of a cake than at a non-food item after hearing the verb "eat" (in phrases such as "the boy will eat..."), suggesting that they anticipated the word "cake" based on the selectional requirements of the verb "eat" (see also Kukona, Fang, Aicher, Chen, & Magnuson, 2011). Furthermore, when there is more than one item that would be a plausible patient for the verb, listeners anticipate the most appropriate one based on the agent (Kamide, Altmann, & Haywood, 2003). Similarly, Dahan and Tanenhaus (2004) found that, when a preceding verb context established thematic constraints, fixations to items in an array were limited to the referent that maximally matched both thematic and phonetic constraints. Such anticipation is the result of experience with both language and the real-life events to which it refers. Eye tracking provides an elegant way to demonstrate this knowledge because it provides an implicit, online measure that participants need not be consciously aware of.

Eye tracking has also been used to demonstrate implicit knowledge of lexical probabilities (McDonald & Shillcock, 2003). While reading sentences, participants' initial-fixation durations—a measure of processing effort—were shorter for verb–noun combinations

* Corresponding author at: Moss Rehabilitation Research Institute, 50 Township Line Rd., Elkins Park, PA 19027, USA. Tel.: +1 215 663 6733; fax: +1 215 663 6783.

E-mail address: allisonbritt@gmail.com (A.E. Britt).

with high transitional probabilities than for pairs with low transitional probabilities. Presumably, skilled readers are able to form online predictions about upcoming words based on their knowledge about word-to-word contingencies.

When listeners encounter temporary syntactic ambiguities, they construct situation-specific evaluations of the utterance, based on perceptual and action-based knowledge (Chambers, Tanenhaus, & Magnuson, 2004). For example, when listeners heard the phrase “pour the egg in the bowl over the flour,” their eye movements indicated that they expected “in the bowl” to be a modifier when the scene contained two eggs in liquid form. However, they expected “in the bowl” to specify the goal when there was only one egg in liquid form.

Listeners also use pragmatic constraints such as the knowledge of the speaker to anticipate upcoming referents (e.g., Barr, 2008; Hanna, Tanenhaus, & Trueswell, 2003). Participants engaged in a task with a confederate were able to track which items were in common ground (known to both participants) and which were in privileged ground (known only to the participant and not to the confederate). When there were two identical items that differed only in whether they were in common or privileged ground, participants used common ground as a contextual constraint and were more likely to look at the item also known to the confederate.

1.2. Learning regularities within an experiment

In addition to using information built up over a lifetime of experiences to make predictions and facilitate processing, participants in experiments can quickly exploit information gleaned from a relatively small number of instances within an experimental setting. Even infants demonstrate this kind of implicit learning: when presented with a stream of syllables, eight-month-olds were later able to discriminate “words” (recurring trisyllabic sequences that always occur in sequence) from “part-words” (recurring trisyllabic sequences with lower transitional probability because they span a “word” boundary) based on transitional probabilities (Saffran, Aslin, & Newport, 1996). Further, this kind of statistical learning facilitates later referential word learning (Graf Estes, Evans, Alibali, & Saffran, 2007; Mirman, Graf Estes, & Magnuson, 2010; Mirman, Magnuson, Graf Estes, & Dixon, 2008).

Similarly, people are able to learn regularities in a stream of visual images. Infants as young as two months showed a reliable preference for novel sequences after they were familiarized with a series of images whose ordering followed a statistically predictable pattern (e.g., Fiser & Aslin, 2001, 2002; Kirkham, Slemmer, & Johnson, 2002). Evidence for learning of visual regularities by adults was shown through faster reaction times on a categorical response task for the second item in pairs of trials that always appeared together, compared to unpaired trials (Turke-Browne, Scholl, Johnson, & Chun, 2010). Functional neuroimaging also revealed that the right anterior hippocampus responded more strongly to the first item in a pair, suggesting that the hippocampus might mediate a form of implicit perceptual anticipation. Although no participants reported being aware of the trial structure and pairs were repeated only six times, behavioral and neural results showed that learning had taken place. Participants also find targets more quickly in a visual search task when they appear in repeated configurations of distractors, compared to inconsistent locations (Chun & Jiang, 1998).

1.3. Effect of learned regularities on priming

Sensitivity to repetition proportion in priming is another type of implicit regularity learning and is particularly relevant to the present study. Bodner and Masson (2001) manipulated the proportion of masked repetition primes in a lexical decision task. Groups received 60-ms repetition primes on either 20% or 80% of trials, with unrelated primes preceding targets for the remaining trials. Both groups showed repetition priming, but the priming effect was exaggerated when the

repetition priming trials made up a higher proportion of trials. The authors proposed that this repetition proportion effect stemmed from participants' ability to tune into regularities in priming stimuli and exhibit sensitivity to the validity of primes as a source of information concerning the target. Similar results were demonstrated with different tasks, such as reading aloud (Bodner & Masson, 2004).

The proportion of related primes has also been shown to influence semantic priming (e.g., de Groot, 1984; den Heyer, 1985; den Heyer, Briand, & Danenbring, 1983; Stolz & Neely, 1995). A greater proportion of related word pairs, relative to unrelated pairs, led to a greater amount of facilitation in lexical decision. In some cases, this effect is only seen with at least several hundred milliseconds between the onset of the prime and the target (e.g., Hutchinson, Neely, & Johnson, 2001; Perea & Rosa, 2002; Stolz & Neely, 1995). However, Bodner and Masson (2003) replicated the effect of relatedness proportion on semantic priming using 45-ms masked primes, suggesting that conscious awareness of primes was not necessary in order for prime validity to influence processing.

1.4. The current study

The current study aimed to bridge several gaps in the existing literature. First, we examined whether repetition priming effects and their modulation by repetition proportion generalize to a more naturalistic task (spoken word-to-picture matching) that does not require meta-linguistic judgments (e.g., lexical decision). This design used a “continuous” or “single-presentation” priming paradigm (e.g., McNamara & Altarriba, 1988; Shelton & Martin, 1992) in which the previous trial is considered the prime for the present trial and participants respond to each stimulus. The more common two-stimulus priming paradigm, in which participants are presented with two stimuli (the prime and the target) and only respond to the second, makes the pairing explicit and therefore encourages strategic processing (for discussion see McNamara & Altarriba, 1988; Shelton & Martin, 1992) even if conscious recognition of the prime is made difficult by brief presentation and visual masking (neither of which can be easily adapted for spoken word processing).

Second, the current study used eye-tracking to examine repetition priming and repetition proportion effects online, in order to connect them with anticipatory fixations in online spoken language comprehension. The priming studies only provide a final response time, so it is less clear exactly when and how the effect occurs—specifically, whether or not there is an anticipatory component to the increased facilitation. The current study combines the high temporal resolution eye-tracking paradigm and the repetition proportion manipulation to examine whether repetition proportion produces anticipatory eye movements in the time period prior to target word onset as well as the ultimate facilitative effect on reaction times.

Finally, many psycholinguistic studies involve repeated presentation of the same stimuli in different contexts or conditions. Researchers seem aware that this kind of repetition may interfere with effects of interest as evidenced by their use of filler stimuli or counterbalancing schemes. However, to our knowledge, the effect of item repetition has not been explicitly examined for these sorts of studies. The current study constitutes a step in that direction and, thus, aims to provide some methodological guidance or considerations for future studies.

The current study used a word-to-picture matching task and tracked participants' eye movements starting when the pictures appeared on the screen, prior to the onset of the target word. The trial sequence included pairs such that some items were repeated from one trial to the next in each pair. The first trial in a pair was akin to a prime in that it could provide some information about the next trial. The critical manipulation was how frequently the first and second trial in a pair had the same target, analogous to the proportion of repetition priming trials. This paradigm differs in several ways from previous investigations of the effects of repetition proportion described above. Most crucially, in

Download English Version:

<https://daneshyari.com/en/article/919853>

Download Persian Version:

<https://daneshyari.com/article/919853>

[Daneshyari.com](https://daneshyari.com)