Appendix B

Details of visibility task

Stimuli

Most of the real-word masked items in the visibility task were novel; that is, they had not been used in the masked priming task or any training task (although four items that had been included in the priming task were inadvertently repeated in this task). Stimuli for the visibility task met the same criteria for word length and font as those for the masked priming task, but there were three substantial differences in the stimuli that were used for this task.

First, the visibility task contained three types of masked items: xg strings, real words, and pronounceable non-words. This was in contrast to the masked priming task, in which masked items were only either xg strings or real words. The decision to include a third condition of masked items to identify in the visibility task was made after pilot data indicated that participants were often able to identify single visual features of the masked items, such as a diagonal line from an "x", and used that to differentiate "non-word" items from "word" items. In these cases, participants would often report afterward that they had simply looked for that single element and, if it was present, had called the item a non-word; if it was not present, they would call the item a word. While this approach provided some information about each participant's ability to see some elements of the masked items, the high measures of visibility that it produced seemed an overestimate of the amount of useful information that participants were gleaning from the masked primes. Therefore, a third condition was introduced: pronounceable non-words. It was reasoned that, if participants could not reliably tell the difference between masked real words and masked pronounceable non-words in the visibility task, then they were not reliably getting consciously useful information from primes to assist in the lexical decision task.

The second difference in the stimuli used for the visibility task, as compared with the masked priming task, was that all items shown at the end of the stimulus presentation sequence (which were "targets" in the masked priming task) were real words, as opposed to the masked priming task, in which they were either real words or non-words. Because these final items in the visual presentation sequence served only to equate the two tasks and signal participants when to respond, their content was largely irrelevant (though see the third difference, discussed in the following paragraph, for a related issue). Therefore, it was decided to make them all real words, to avoid any confusion over which item in the sequence - the masked lower case letters or the clearly visible upper case letters - was the object requiring a lexical decision judgment.

Related to the use of only real words in the "target" position on this task is the third difference in stimuli between the visibility and masked priming tasks: the string of letters shown at the end of the stimulus presentation sequence in this task never matched the masked item, whereas primes and targets for primed items in the masked priming task always matched. This was done to reduce the chances of backward priming from the target influencing the conscious identification of masked letters (e.g., in the manner reported by Kiger and Glass, 1983).

Procedures

Details of the procedures for this task have been reported elsewhere (Silkes and Rogers, 2010). In brief summary, the visibility task involved presentation of visual sequences nearly identical to those described for the lexical decision task, with participants asked to make lexical decisions on the masked items rather than on the unmasked items at the end of the stimulus sequence. This task was done only after completing the masked priming task, so that participants were not alerted to the presence of prime items in the masked priming task. For the participants with aphasia, verbal instructions were simplified and/or supplemented with writing, gesture, and

demonstration to maximize comprehension. Participants were given an opportunity to practice this task until they felt confident that they understood it. The practice task was identical in structure to the 1500 ms ISI visibility task condition, although with different stimuli.

As with the masked priming task, visibility was assessed in eleven ISI conditions. Each ISI condition was assessed in a separate run of 16 items: eight masked real words, four xg strings, and four pronounceable non-words. All words and pronounceable non-words met the same criteria as in the masked priming task. No masked item was presented more than once in this task. Every participant began this experimental task with the 1500 ms ISI condition and continued with progressively shortening ISIs. This fixed sequence of presentation, with the easiest-to-discern conditions presented first, was used to maximize the chances of participants being able to detect the masked items, so as not to underestimate their visibility. As with the masked priming task, responses to the visibility task were made by button press, with the same assignment of which button to press for *yes* and *no* (left or right) maintained from the masked priming task for each participant. Participants were instructed to make their decision on the masked item in each trial, but not to respond until the unmasked word at the end of the sequence appeared. This delay was imposed to equate the visibility and masked priming tasks as much as possible. The same response deadlines as in the masked priming task applied: 650 ms from onset of the unmasked word for control participants, and 1000 ms for individuals with aphasia.

Data collection and processing

Details of the data collection and processing methods for the visibility task have been presented in detail elsewhere (Silkes and Rogers, 2010), although that report did not describe its application to determining which responses were included or excluded from data analysis for the priming task; that description is included here. In short, each participant made 16 responses in

each of the 11 ISI conditions, for a total of 176 responses per participant. No visibility data could be collected for three individuals with aphasia, due to difficulty establishing the task after multiple attempts with extensive demonstration and cuing. These participants indicated that they were unable to perceive any of the masked items in the visual sequence when they were presented at the 20 ms exposure duration as in the experimental task, which led to their inability to complete the visibility task. Given their inability to perceive the masked items, even with multiple forms of cuing and assistance, it is assumed that these three participants had no conscious awareness of the prime items.

Accuracy and reaction time data from the button-press responses in the visibility task were downloaded from E-Prime. All targets were analyzed for response accuracy. Responses that were made beyond the response deadline for either group were counted as incorrect, under the assumption that a significant delay was likely to be an indication of difficulty deciding which response to make, which would reflect poor conscious perception of the masked item.

Each participant's ability to extract task-relevant information from the masked items in each ISI condition was assessed using d´ (Green and Swets, 1966), which uses the proportion of accurate responses and false alarms to determine a person's ability to reliably discriminate between the different types of masked stimuli. Specifically, d´ was calculated for a participant's discrimination between masked real words and xg strings and between masked real words and pronounceable non-words. Poor discrimination between stimuli is indicated by d´ values approaching or equal to zero, while better discrimination is reflected in higher values. Positive d´ values are typically interpreted to mean accurate identification of group membership, while negative d´ values indicate inverse, albeit consistent, identification (i.e., real words identified as non-words and vice versa). In this particular study, however, because d´ values were being used

to infer the availability of meaningful information about the masked items, if a participant was identifying masked items consistently incorrectly it was assumed that s/he was not getting meaningful information from those items. Therefore, visibility criteria used in this study were based only on positive d´ values; negative values were taken as functionally equivalent to zero.

The primary purpose of the visibility task was to determine if any participants may have had conscious awareness of the prime items, which would interfere with the ability to interpret any priming effects as strictly implicit. An operational definition of "visibility" was therefore created based on the assumptions a) that discrimination of words and pronounceable non-words is more difficult than discrimination of words and xg strings (supported by findings of significantly higher d' values for Word-XG discrimination than Word-Pronounceable Non-Word discrimination for control participants; see Silkes and Rogers, 2010, for full discussion of this data set); and b) that masked items in longer ISI conditions are easier to perceive consciously than those in shorter ISI conditions, due to the additional masking effect of the target item in shorter ISI conditions. With these assumptions in mind, the following operational definition of visibility was created: a given ISI condition for a particular participant was judged to have potentially been contaminated by conscious awareness of the masked prime if the d´ values for both the Word-Pronounceable Nonword discrimination and the Word-XG String discrimination were >1.5 for the ISI condition in question *and* in all longer ISI conditions (with the exception of the 1500 ms ISI condition, which was the longest).

This definition of visibility was adopted because it was apparent, on looking at the data, that misleading d´ values were being obtained due to the small number of tokens available for this task. Because d´ calculations are based on proportions of hits and false alarms, with only four of each type of non-word token available, small amounts of random variation in accuracy

rates, even when participants were only guessing, led to large differences in d´ values. Therefore, for instance, a high d´ value for the Word-Pronounceable Nonword distinction might be obtained by chance in a very short ISI condition, when there was no evidence of prime visibility in longer ISI conditions, or when the Word-XG String discrimination was poor. In these cases, it was logical to assume that the high d´ value was erroneous and obtained by chance, rather than reflective of actual ability to discern meaningful information from the masked prime. The need to operate under this assumption is recognized as a limitation of how this task was designed, and is discussed in greater detail by Silkes & Rogers (2010), which provides a detailed description of this process and analysis of the visibility data collected for this project.

References

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