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Reply

Strategic control in AGL is not attributable to simple letter frequencies alone ☆

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ABSTRACT

In Norman, Price, and Jones (2011), we argued that the ability to apply two sets of grammar rules flexibly from trial to trial on a “mixed-block” AGL classification task indicated strategic control over knowledge that was less than fully explicit. Jiménez (2011) suggested that our results do not in themselves prove that participants learned – and strategically controlled – complex properties of the structures of the grammars, but that they may be accounted for by learning of simple letter frequencies. We first explain why our main conclusions regarding strategic control and conscious awareness are a separable issue to this criticism. We then report additional data which show that our participants’ ability to discriminate between the two grammars was not attributable to differences in simple letter frequencies.

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We have reported (Norman, Price, & Jones, 2011) that AGL participants trained on two different grammars were able to selectively apply each of these two grammars while inhibiting the other, which is in line with previous findings (Dienes, Altmann, Kwan, & Goode, 1995; Wan, Dienes, & Fu, 2008). In his commentary article, Jiménez (2011) argues that we cannot straightforwardly conclude from our data that our participants exhibited strategic control over complex properties of the structures of the grammars. Instead, he proposes that the results may simply be accounted for by knowledge related to differences in the relative frequencies with which individual letters occurred in the two sets of letter strings. This conclusion is based on his analysis of the probability of appearance of each individual letter in two sets of 1000 strings generated from the two grammars, as well as in the specific sets of letter strings used in our experiment and which were identical to those used by Dienes et al. (1995) and Wan et al. (2008). Jiménez’ analysis shows that the frequency of each letter is not balanced between the two grammars in either of these sets.

We certainly agree with Jiménez that studies of learning and strategic control in AGL should aim for the highest possible level of methodological control. In fact the very thrust of our paper was to identify possible shortcomings of the two-grammar AGL paradigm as it has been studied in the past, and to introduce two methodological modifications to address these shortcomings. One was the “mixed-block” testing procedure (i.e., varying the target grammar randomly from trial to trial within blocks) which we argue is a more stringent test of strategic control than the existing “pure-block” procedure (i.e., varying the target grammar only across blocks). Another was to introduce random variation in the colors and fonts of indi-

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vidual letters, which makes it possible to assess whether strategic control occurs in the absence of explicit awareness of the nature of the grammar rules. The main contribution of our experiment was to show that (a) AGL participants can exhibit strategic control over their grammar knowledge even when a more stringent measure of strategic control is applied, and that (b) strategic control in AGL is not limited to participants who express explicit knowledge of the nature of the grammars; instead we found strategic control even among participants who reported that the rule was not related to letters, but to stimulus dimensions that in fact varied randomly and were therefore irrelevant as far as the real letter-based grammar was concerned.

In our opinion these conclusions regarding strategic control in the absence of explicit grammar knowledge are orthogonal to Jiménez' criticism. If a response heuristic related to differences in simple letter frequencies between the two grammars was explicit, participants who used this heuristic would have been likely to report on our post-experimental questionnaire that letters contributed to the rule. Even if it was the case that some "unaware" participants responded on the basis of implicit knowledge of simple letter frequencies, our arguments concerning strategic control in the absence of explicit learning would still hold. For the focus of our paper, the specific content of the acquired knowledge was subordinate to the general question of whether knowledge which is unconscious according to a verbal report criterion can be strategically controlled.

However in order to address Jiménez' concern more directly we have now conducted a set of additional analyses on data from the test phase of our critical mixed-block condition. For each participant ($N = 20$), we selected all trials on which they had chosen an item that followed either of the 2 grammars (whether or not it was the target or non-target grammar), and we calculated five difference scores, reflecting the difference between the target and non-target item in the frequency with which each of the five letters appeared. For each letter, participants' tendency to pick the target (rather than the non-target) item was regressed on these difference scores. One-sample t -tests were conducted on the slopes of the regression lines and the intercepts for each letter. No slopes were significantly different from zero (all p 's $> .36$), suggesting that the tendency to select the target rather than the non-target grammar was not influenced by the relative frequency of any individual letter. Moreover, all the intercepts were significantly higher than a chance level of 0.5 (all p 's $\leq .02$) indicating that participants still showed strategic knowledge (i.e., ability to pick the target rather than the non-target grammar) when these letter frequencies were controlled for.

Even though we have argued that differences in simple letter frequencies between the two sets of letter strings did not account for our results (Norman et al., 2011) and are also not critical to the theoretical questions raised in our paper, Jiménez (2011) has raised a very legitimate general methodological concern that should be recognized and controlled for in future AGL research.

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