Block, N. (2022). "Word Representations and Ampliative Transitions: Reply to Steven Gross." *Analysis Reviews.*

Word Representations and Ampliative Transitions: Reply to Steven Gross

In a wonderfully insightful article, Steven Gross points to a serious problem with the views in my book. Luckily for me, he suggests a number of ways that I can modify my views while keeping the main lines of them intact.

Abstract Word Representations

The problem Gross raises involves my thesis that perceptual representations are constitutively iconic in format. What is iconic format? I discuss a number of somewhat different characterizations of iconicity used in cognitive science but the one that I take to be most important is a "mirroring" characterization based on Roger Shepard's notion of second-order (Shepard, 1978; Shepard & Chipman, 1970). The main idea of the "mirroring" characterization is that relations among perceptual representations are analogs of relations among the properties in the world that are perceptually represented. But there are other notions of iconicity used in cognitive science, and Gross's critique does not depend on any one particular kind or notion of iconicity.

The problem raised by Gross is that I hold that one of the constitutive features of perception is iconic format while at the same time leaning on adaptation as a strong (though imperfect) indicator of perception. He notes a difficulty for that combination of views based on an experiment by (Hanif, Perler, & Barton, 2013).

The way the experiment works is diagrammed in the figure in Gross's paper and with different details in Figure 1 below. An adaptor, in this case an upper or lower case word, is presented for 5 seconds. The word pairs 'area/name' and 'crane/nerve' were used because the words are matched for familiarity, imageability and concreteness and it is possible to make a stimulus that is ambiguous between them both in upper and lower case. What is illustrated in Figure 1 is the version in which the adaptor is either 'area' or 'AREA'. A mask is then presented briefly. Experiments like this often use masks to prevent the perceptual representation from continuing after the stimulus is ended.

Then, after 300 ms, an ambiguous stimulus is presented (this time with no mask). In the case illustrated in the figure, the ambiguous stimulus is ambiguous between an upper case 'AREA' and upper case 'NAME'. Then the subject has a choice between lower case 'area' and 'name'. The "congruent" version is when the ambiguous stimulus is the same case as the adaptor, the "incongruent" version is when the ambiguous stimulus is in the opposite case from the adaptor. The choice is always between items of the opposite case from the adaptor. (So what is pictured assumes the adaptor is 'AREA'.) The signature of adaptation is that the subject will be biased against seeing the ambiguous word as the word initially presented, i.e. the adaptor. And that is what happens. Seeing 'AREA' for 5 seconds makes one much less likely to choose 'area', i.e. much more likely to choose 'name'. This is the classic "repulsive" effect of adaptation.

Hanif, et al. showed a “cross-case” adaptation effect for visually presented words in which an adaptor word had a “repulsive” effect on seeing another word, irrespective of whether the adaptor words were written in a different case from the adapting words. (They showed similar results for varying font and handwriting style, but I will discuss only the case result.) The problem for me is how there can be an iconic representation of a word that abstracts from case, given that there doesn’t seem to be iconic format shared between the lower case and upper case words.

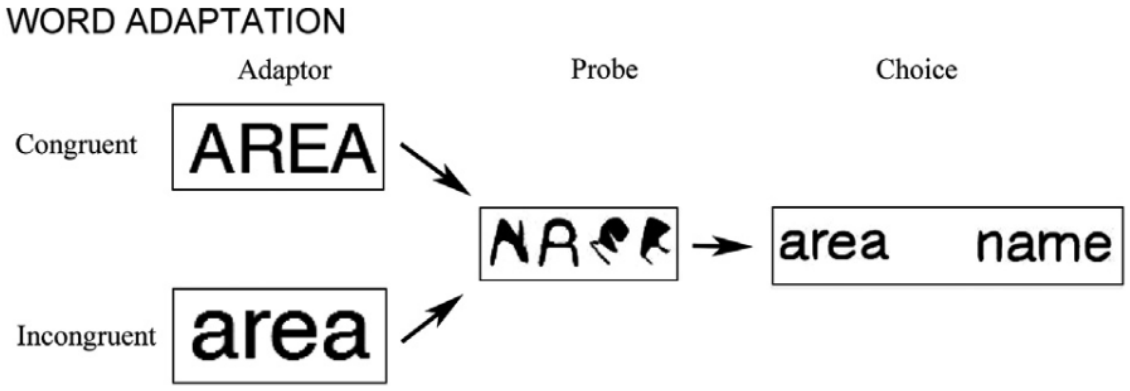

Figure 1 From Hanif, et al., p.69. Thanks to Jason Barton for this figure.

The key finding from my point of view is that the effect works in both the congruent and incongruent versions. That is, when the adaptor is a lower case ‘area’ that makes one more likely to respond to the upper case ambiguous stimulus as ‘NAME’ and when the adaptor is an upper case ‘AREA’ that makes one more likely to respond to the lower case ambiguous stimulus as ‘name’. There is some indication in the data that the congruent effect is bigger than the incongruent effect. See Figure 2.

The difference shown in Figure 2 is large but not significant. Philosophers may wonder how that can be? If I measure the height of the students in my small seminar and find that the students whose name begins with ‘A’ are on average two feet taller than the students whose name begins with ‘B’, we have a large difference that can be explained by a chance effect in a small sample size. The case experiment had only 14 subjects and not many trials. However, Hanif, et al. also showed in a different experiment from the one just reported that there is an adaptational effect of case, so it may well be that the effect of Figure 2 is real.

However, the problem for me is that there is any effect at all in the incongruent version since that suggests a perceptual word representation that is neutral between upper and lower case and that does seem in tension with an iconic theory of perceptual representation.

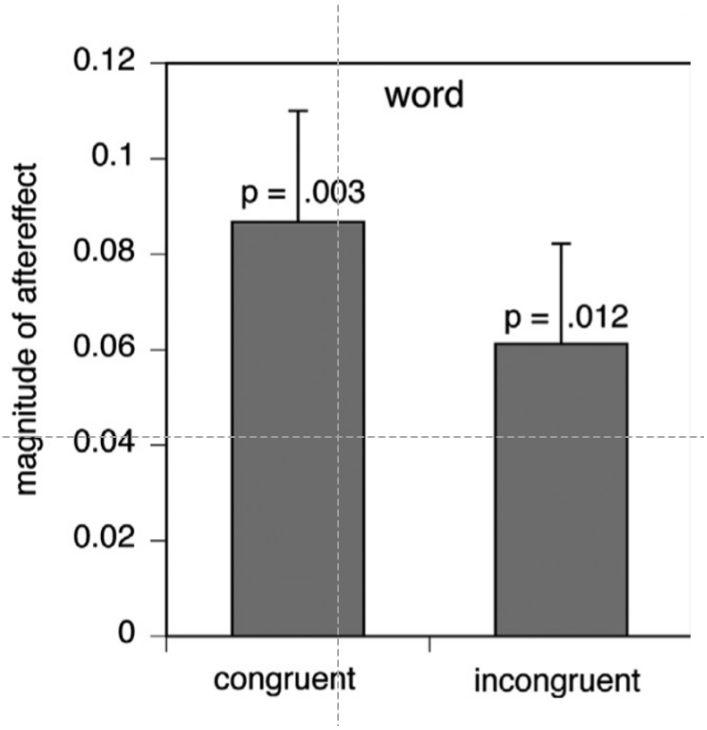

Figure 2. Slightly modified from Hanif, et al. Figure 3, p. 64. Thanks to Jason Barton for this figure and permission to modify it slightly.

I agree there is a level of word form representation that is more abstract than either the lower case or the upper case word representation. The problem is how that representation can be iconic. Focus on the words 'AREA' and 'area' in Figure 1. If that word were slowly rotated, the mirroring "rotation" of the perceptual representation would depend on whether what is rotated is 'AREA' or 'area'. One indicator of iconicity is whether two tokens of the same iconic type can be superimposed, preserving format, and upper and lower case formats do not pass this test.

It is possible to make a picture of a word that is ambiguous between lower and upper case—and the experimenters did that for both upper and lower case 'area', 'name', 'crane' and 'nerve'. But just eyeballing the one example they give in Figure 1, the techniques are to alternate upper and lower case letters and use ink blobs and that technique does not seem to lend itself very well either to the mirroring or superimposition criteria.

Gross offers a number of possible ways out. One way, he suggests, is to treat this as an "edge-case" that no more challenges the joint than twilight challenges the distinction between day and night. I discuss a number of "borderline" examples similar to the twilight example. For example, I note that the existence of glasses that are hard as with solids but have the amorphous structure of liquids do not impugn the explanatory significance of the division of matter into liquid, solid and gas. There is more than one way to make a liquid into a solid. In the case of a water to ice, the way involves changing an amorphous molecular structure into a crystalline lattice. That is explanatorily significant even if supercooled liquids exemplify a more gradual way of

solidifying. A case of perception that was discursive, however, would however threaten the explanatory unity of iconicity, non-conceptuality and non-propositionality.

One promising option suggested by Gross is that there may be associative links between upper and lower case representations so that activation of one activates the other. The thought here is that 'area' has an adaptive effect on 'AREA' because 'area' triggers an instantiation of 'AREA' and that has an adaptive effect on 'AREA'. This theory would also explain why the incongruent effect is smaller than the congruent effect—because the incongruent effect is mediated by an association and so is not direct.

As Gross notes, there might also be an associational effect mediated by overlearned associations between orthography and phonology. Look at Figure 1. You see (say) 'area' for 5 seconds. We know from many experimental results (e.g. the Stroop effect) that for most adults reading is automatic. Anyone looking at 'area' for 5 seconds is going to read the word, activating the representation of 'area' at all levels, including at the phonological level. Then one sees the ambiguous stimulus for 300 ms. Since there is no mask after the ambiguous stimulus, one might continue to process it for another 150 ms before the choice between the two words is given. It is well known that both meanings of ambiguous words are automatically processed in parallel (Lucas, 1987), and something analogous might apply to both readings of the morph. Then, the story goes as applied to when seeing 'AREA' biases one against 'area' and towards 'name': seeing 'AREA' activates the sound of the word, biasing one against the sound of 'area', thereby negatively priming the orthographic 'area'. If we write the sound of 'AREA' and 'area' as /area/, we could put it like this: Seeing 'AREA' activates /area/, seeing the ambiguous stimulus activates both /area/ and /name/, but the activation of the first /area/ suppresses the second, leading to favoring /name/.

Ampliative Transitions

Gross considers the question of whether the transition between perception and basic perceptual belief is "ampliative" in the sense that content is changed.

As Gross notes, I suggest precisifying Burge's notion of a basic perceptual belief as a minimal immediate direct perceptual judgment. I won't repeat the definitions of these terms except for 'minimal' which I defined in terms of conceptualizing each representational aspect of a perception and no more. On my account, perceptual beliefs are conceptualized versions of perception. I say that conceptualization is the product of global broadcasting in which long range axons connect perceptual areas with prefrontal cortex, allowing for an active neural coalition that yields inferential promiscuity (to use Stich's term). It is that inferential promiscuity that makes the representation a concept.

I argued that the process of conceptualization changes the format of representation at least somewhat and also encloses the perceptual representation in a discursive envelope, so contrary to Burge, the formation of basic perceptual belief is ampliative.

One of the kinds of changes that I mention is that basic perceptual belief is coarser grained than perception. Gross mentions also that there are cognitive "biases" that for example favor the categorical center. These are just two of the ways in which the

transition is ampliative. As I mentioned in Chapter 5, perceptual beliefs depend on the task. Yuna Kwak and Clay Curtis (2022) used two kinds of stimuli on different trials, oriented gratings (Gabor patches) and clouds of moving dots. Subjects' task was to indicate the orientation of the grating or the direction of the moving dots after a delay period. They scanned the subjects using fMRI during the delay period prior to doing the tasks. One result was that decoding trained on the grating task also worked on the dot task and vice versa. This fact shows that the working memory representation was sufficiently abstract as to be common between the two perceptions. This working memory result suggests that two different perceptions may yield the same basic perceptual belief, and if so, that transition would certainly be ampliative.[1]

Hanif, H. M., Perler, B. L., & Barton, J. S. (2013). The visual representations of words and style in text: an adaptation study. *Brain Research, 1518*, 61-70. doi:10.1016/j.brainres.2013.04.036

Kwak, Y., & Curtis, C. E. (2022). Unveiling the abstract format of mnemonic representations. *Neuron*. doi:https://doi.org/10.1016/j.neuron.2022.03.016

Lucas, M. M. (1987). Frequency Effects on the Processing of Ambiguous Words in Sentence Contexts. *Language and Speech, 30*(1), 25-46. doi:10.1177/002383098703000103

Shepard, R. (1978). The mental image. *American Psychologist, 33*(2), 125-137.

Shepard, R., & Chipman, S. (1970). Second-order isomorphism of internal representations: Shapes of states. *Cognitive Psychology, 1*(1), 1-17.

[1] Thanks to Susan Carey and Steven Gross for comments on an earlier version.