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Manipulating Visual Experience: Comment on Op de Beeck and Baker

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In their recent *TiCS* contribution, Op de Beeck and Baker [1] (hereafter OB) suggest we abandon the idea that fairly local changes, limited to a single visual area, support visual learning. Instead, they propose that visual experience causes moderate and distributed changes that modulate pre-existing representations. We argue that their review overlooked something critical: The kind of experience matters to how we learn visually. Unlike OB, we believe that *both* local and distributed changes can accompany visual object learning, depending on the task demands during learning.

OB review studies that use a wide variety of training tasks. For instance, participants (humans or monkeys) learn to categorize objects in one particular way [2], learn to discriminate visually similar objects [3] or learn to individuate objects by associating individual labels to them [4]. By focusing on the common aspects of visual learning, OB fail to note the potential importance of these training differences. This oversight is hard to avoid given current evidence. Indeed, many studies contrast categories that differ in shape, so we know that shape matters to the visual system [5]. Many studies hold shape constant but vary what participants are asked to attend to, so we know that attention can modulate visual responses [6]. And many studies, reviewed by OB, show that experience of some sort can change visual representations [2–4,7,8]. But because almost none of these studies *manipulate experience*, we have failed to learn much about whether the kind of experience with objects matters or not. As acknowledged by OB, most studies cannot even conclude if the learning effects obtained were a result of the complex training tasks or mere exposure to objects.

Recent work of ours manipulated experience by training different groups of participants with the same objects called “Ziggerins” (Fig. 1) for the same amount of time, but in very different ways [9,10]. One group learned to individuate Ziggerins by associating them with individual names, as in prior Greeble training studies. Another group learned to categorize objects according to common configuration of parts and practiced rapidly scanning arrays of many Ziggerins. Behaviorally, while both groups learned to process the objects faster, only the first group learned to perceive Ziggerins holistically [9]. In the visual system, learning to individuate led to local changes in the right fusiform gyrus, correlated with changes in

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holistic processing [10]. By contrast, learning to categorize and scan led to bilateral and distributed changes all along the occipito-temporal pathway.

In sum, the neural basis of visual learning depends on the kind of experience we have learning about objects. Until more studies systematically manipulate experience, it may not be warranted to suggest that all visual object learning relies on the same mechanisms.

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Figure 1.
The Ziggerins, objects used in a comparison of training paradigms [9,10]. Each row shows 12 different individuals within the same category.