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Hidden Differences in Phenomenal Experience

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Abstract

In addition to the many easily observable differences between people, there are also differences in people's subjective experiences that are harder to observe, and which, as a consequence, remain hidden. For example, people vary widely in how much visual imagery they experience. But those who cannot see in their mind's eye, tend to assume everyone is like them. Those who can, assume everyone else can as well. We argue that a study of such hidden phenomenal differences has much to teach cognitive science. Uncovering and describing this variation (a search for unknown unknowns) may help predict otherwise puzzling differences in human behavior. The very existence of certain differences can also act as a stress test for some cognitive theories. Finally, studying hidden phenomenal differences is the first step toward understanding what kinds of environments may mask or unmask links between phenomenal experience and observable behavior.

Keywords: Phenomenology; Individual differences; Perception; False consensus; Cryptic variation; Neurodivergence

On April 22, 2016, Blake Ross, the co-creator of the Mozilla web browser published a Facebook post that quickly went viral. It began: "I just learned something about you and it is blowing my [expletive] mind." What did Ross learn? That the phenomenal experience of most other people was very different from his own:

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> "I have never visualized anything in my entire life. I can't 'see' my father's face or a bouncing blue ball, my childhood bedroom or the run I went on ten minutes ago. I thought 'counting sheep' was a metaphor. I'm 30 years old and I never knew a human could do any of this." (B. Ross, 2016)

It turns out that realizations such as Ross's (of what is now called aphantasia, Zeman, Dewar, & Della Sala, 2015) are not isolated cases. In April 2016, Erika Hayasaki (2016) wrote about Susie McKinnon, a middle-aged woman with no autobiographical memory: "She knew that other people claimed to have detailed memories, but she always thought they embellished and made stuff up—just like she did." Cases as extreme as McKinnon's are rare, but have led to the discovery of large-scale individual differences in autobiographical memory (Palombo, Sheldon, & Levine, 2018; Sheldon, Farb, Palombo, & Levine, 2016) of which individuals are largely unaware. And then, there was Cates Holderness, a Buzzfeed community manager who on February 26, 2015 set the internet ablaze by posting a picture of a dress (#theDress; 2015).

From a young age, we notice differences between people: some people are tall, some are shy, and some are faster runners. But the three differences described above are of a different sort. These *phenomenal differences* concern differences in inner experiences that are easy enough to observe in ourselves, but difficult to observe in others. And so, such differences tend to stay *hidden*, remaining out of sight, and so, out of mind.

We are not surprised to learn that what looks vaguely greenish to us may appear vaguely blueish to someone else. But, prior to #theDress, we had no reason to think that what looks like an obviously white-and-gold dress could appear qualitatively different to a friend looking over our shoulder at the identical image. Similarly, someone who does not experience visual imagery has no reason to assume that others do; someone who experiences color-grapheme synesthesia has no reason to think that others do not. It is only when we start to carefully compare notes that we realize our perceptual and cognitive worlds often differ in striking ways.

Some hidden phenomenal differences are being actively studied. Researchers are describing the variation, relating it to differences in behavior, and in some cases, trying to understand the developmental origins of this variation. Examples include differences in visual imagery (Dawes, Keogh, Andrillon, & Pearson, 2020; Kay, Keogh, Andrillon, & Pearson, 2022), inner speech (Alderson-Day & Fernyhough, 2015; Hurlburt, Heavey, & Kelsey, 2013; Roebuck & Lupyan, 2020), autobiographical memory (Berntsen, Hoyle, & Rubin, 2019; Palombo et al., 2018), and what is probably the hidden phenomenal difference *par excellence*, synesthesia (Cuskley, Dingemanse, Kirby, & van Leeuwen, 2019; Eagleman, Kagan, Nelson, Sagaram, & Sarma, 2007; Jewanski, Simner, Day, Rothen, & Ward, 2020).

But how do we go about discovering *new* phenomenal differences—a search for unknown unknowns? In an attempt to make some of these known, we have been administering questionnaires inspired by a combination of social media posts, discussions on Reddit (e.g., Phantomomega, 2020), and casual conversations with colleagues and students. We then deployed these questionnaires to college students and crowdworkers. Three examples of hidden phenomenal differences are shown in Fig. 1-left. Are these differences really hidden? To find out, we can leverage a method used in the study of false-consensus effects (L. Ross, Greene,

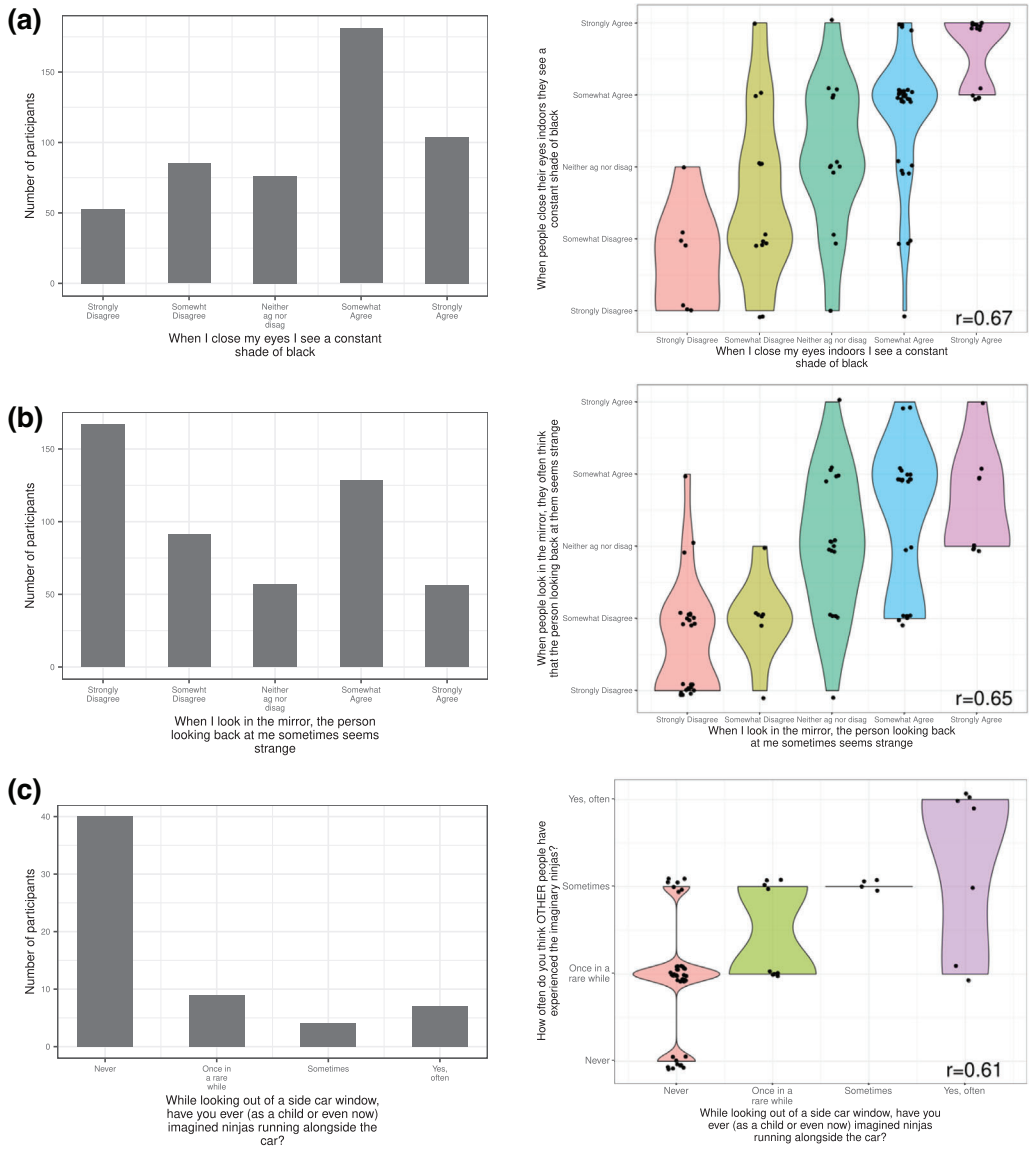

Fig. 1. Examples of hidden phenomenal differences. (a, b) Results from two questions from a formal survey. Left: response profiles ($n = 500$). Right: a new validation sample ($n = 80$) in which participants were asked questions about themselves and others. (c) Informal classroom survey ($n = 60$) inspired by Reddit posts about imaginary ninjas. High self-other correlations suggest that participants are projecting their experiences onto others and hint that the phenomenal difference in question is partially hidden. For example, of the 14 people who strongly agreed that on closing their eyes they see a constant shade of black, *all* thought that others do as well, at least somewhat. Of the seven who strongly disagreed, *none* thought others somewhat or strongly agreed with this statement.

& House, 1977) wherein people are asked to respond about themselves and about others. A strong correlation between self-other responding implies people think others are just like them. In all three of these cases (Fig. 1-right), we see precisely this, with correlations around $r = .6$. In contrast, when we ask people about personal preferences (e.g., putting milk in coffee) or about observable behaviors (e.g., typical bedtime), the self-other correlations are much lower, on the order of $r = .15$.

The high self-other correlation helps explain the shock that often accompanies people's realization that their experience is not shared by others. It simply does not occur to us (scientists and laypersons alike) that something as basic as closing our eyes should be accompanied by very different experiences, but they are(Fig. 1a)![1] There is an additional reason, however, why these differences remain hidden: their consequences for everyday behavior are often much more subtle than we expect (arguably, if the behavioral effects were much larger, the phenomenal difference would cease to be hidden!)

Why do these hidden phenomenal differences exist? What are the consequences of discovering them for cognitive science (and for cognitive scientists)? One answer to the *why* question may at first seem circular: They exist because they can. For example, the reason there is not much variability in the location of the human nose is—presumably—because allowing it to vary would wreak havoc on numerous developmental cascades. The existence of substantial hidden variability in imagery, inner speech, synesthesia, and in many other still-to-be-discovered domains suggests that this variability can exist (and can accumulate) without wreaking such havoc.

A parallel situation may exist in genetics. "Cryptic genetic variation" is a genetic variation without clear phenotypic correlates. It has been argued that this variation provides an important reservoir of latent variability that becomes unmasked in new environments or during environmental shocks (Le Rouzic & Carlborg, 2008; Paaby & Rockman, 2014). This environmental unmasking of cryptic genetic variation can then rapidly boost trait heritability. For example, in stickleback fish, a move from a saltwater to a freshwater habitat is accompanied by a 30-fold increase in the heritability of body size in the immediate next generation (McGuigan, Nishimura, Currey, Hurwit, & Cresko, 2011).

Why are hidden phenomenal differences of interest to cognitive science? First, understanding variation in people's phenomenal experiences may help predict and explain behavioral differences. For example, if people with an early aptitude for music were discovered to represent music in an especially spatial way (Hassler, Birbaumer, & Feil, 1985), this difference would shed light on the nature of musical aptitude. But phenomenal differences may be of interest even if links to behavior are subtle or absent; this subtlety hints at hidden robustness. Indeed, gross similarities in behavior in the face of different phenomenal experiences suggest the presence of new ways of accomplishing a task (e.g., using kinesthetic imagery in place of visual imagery for visual working memory tasks) which can be understood within the larger biological principle known as degeneracy (Edelman & Gally, 2001)—which confers robustness to biological processes.

Consider color blindness. This easy-to-establish perceptual difference has seemingly obvious behavioral consequences. And yet, prior to testing, about half of people with color blindness have no idea their color vision is different from others (Miles, 1929). How could this

be? Should not they routinely make identification and naming errors? Turns out, they do not. Outside the lab, identification and naming are robust enough to not be much affected by such deficiencies in color perception (Bonnardel, 2006).

Second, discoveries of hidden phenomenal differences provide stress tests for theories. For example, given the prominence of visual imagery in cognitive theorizing (Barsalou, 2008; Ishai & Sagi, 1995; Kosslyn, 2005), one might think that its absence would lead to massive behavioral consequences, for example, vastly different performance on tests of visual working memory.[2] Yet, behavioral differences accompanying aphantasia are quite subtle (Bainbridge, Pounder, Eardley, & Baker, 2021). For example, aphantasics and typical imagers show similar accuracy on visual working memory tasks (Keogh, Wicken, & Pearson, 2021). Further examination reveals that aphantasia *is* associated with the use of different strategies and is associated with different patterns of task correlations. We find similar kinds of subtle effects when we examine the consequences of differences in inner speech (Roebuck & Lupyan, 2020), another phenomenal difference that one might expect to have large behavioral consequences. To the extent that inner speech is sometimes viewed as constitutive of (at least some types of) reasoning (Carruthers, 2002), the presence of people who do not experience inner speech and yet appear to have normal reasoning, presents a challenge.

Third, studying hidden phenomenal differences provides an opportunity to observe how differences without obvious links to behavior can become unmasked or masked in new environments. For example, dyslexia might remain a hidden difference in a culture where no one learns to read. Conversely, differences in people's sense of direction can become hidden when everyone relies on a personal global positioning device (GPS) for navigation. How many other such cases might exist?

Hidden phenomenal differences may also help us to understand the behavior of cognitive scientists. Assuming that others are just like us means that a researcher with vivid visual imagery is likely to place imagery in a more theoretically central position than someone with poor imagery (Faw, 2009; Reisberg, Pearson, & Kosslyn, 2003). There is reason to think that this relationship between imagery and theorizing is far from the only case where personal phenomenal experiences guide the cognitive science we as researchers do.

In our pursuit of an objective generalizable science of the mind, cognitive scientists have inherited a tendency from our behaviorist predecessors: to ignore subjective experience, especially when such experience is variable or idiosyncratic. But the dramatic variability in people's inner experiences is a rich source of information about how minds work. The study of these phenomenal differences can help us understand which ostensibly universal components of cognitive theories may be optional, and how similar behaviors can arise from different mechanisms. It can also help to keep us humble in the realization that the "psychic unity of humankind" does not imply a unity of inner experience.

Notes

1 This particular difference in "eigengrau" appears to be a variety of "visual snow" (Schankin & Goadsby, 2015).

2 Could it be that the reason it is hard to find behavioral correlates of aphantasia is that people are just failing to correctly report their experience, that is, that aphantasia does not really exist? There is legitimate reason to doubt self-report in some cases, for example, concerning perceptual qualities of dreams (Schwitzgebel, 2013). But when it comes to aphantasia, objective behavioral correlates *do* exist (e.g., Dawes, Keogh, Robuck, & Pearson, 2022; Kay, Keogh, Andrillon, & Pearson, 2022). Additionally, if you, the reader, are confident that you experience mental images, why suspect that others are confabulating when they report not experiencing them?

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