Perspective

Learning from illusions: From perception studies to perspective-taking interventions

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ABSTRACT

Visual illusions have always fascinated people but they have often been confined to the field of entertainment. Although philosophers, psychologists and neuroscientists have used them to explore the bases of human perception and to teach about vision, these attractive tools have still remained largely underexploited. The goal of the present paper is to argue that visual illusions can also serve as a powerful medium to question our relation to the world and to others, as they demonstrate that we do not fully perceive reality and that each interpretation of the world may be equally sound. Further, specific 3D visual illusions, such as 3D ambiguous objects that give rise to two specific interpretations, enable the viewer to realize that their perception is tied to their viewing point, and that this may also apply to social cognition and interactions. Specifically, this low-level embodied experience should generalize to other levels and enhance the consideration of others' perspective independently of the type of representations. Therefore, the use of illusions in general, and 3D ambiguous objects in particular, constitutes an avenue for future interventions designed to increase our perspective-taking abilities and the pacification of social relations through mutual understanding, which is particularly relevant in the current era.

"Strictly speaking, the concept of illusion has no place in psychology because no experience actually copies reality." - Boring (1942)

"There may be no meaningful way to distinguish between those perceptions that should be classified as 'veridical' and those that should be classified as 'illusory'." - Rogers (2017)

There is a long tradition in experimental psychology to take advantage of perceptual illusions. They have been used to reveal various psychological and neurophysiological phenomena that are at play during perception such as cross-modal interaction (McGurk and MacDonald, 1976), bottom-up vs top-down effects on perception (Spillmann and Dresp, 1995), the specificity of visual processing streams (Coello et al., 2007), probabilistic reactions of pupils (Laeng et al., 2022), etc. For the vision scientists, "Illusions compel humans to view the world with a sense of amazement and give us a better understanding about how the brain constructs a version of reality" (Shapiro and Todorović, 2017, p. xxii). In the present note, we argue that the use of illusions in psychology can be extended to other purposes than just shed light on neurocognitive

mechanisms. In particular, we suggest that some illusions would represent a privileged mean to develop perspective-taking abilities - through powerful bottom-up mechanisms – and, in turn, favour mutual understanding among humans.

Obviously, illusions are a fascinating and widely appreciated phenomenon in both mainstream (e.g. Maurits Cornelis Escher, Salvador Dali, Viktor Vasarely, …) and popular art fields, as evidenced by the number of magazine papers, books, posters, video-clips, or T-shirts dedicated to them. There seems to be two main ingredients in the attractive power of illusions. One basic aspect relies on the positive affects triggered by their mere perception (Erle et al., 2017; Topolinski et al., 2015; Wagemans et al., 2013), as it could be the case when attending to magical tricks. The second aspect is linked to the challenging aspect of illusions: they allow us to become aware of unconscious inferences of our perceptual systems (Banaji and Greenwald, 2013). Because we automatically interpret signals received by sensory organs, perception is usually fast and reliable, and appears simple and straightforward. As a consequence, we usually do not question the
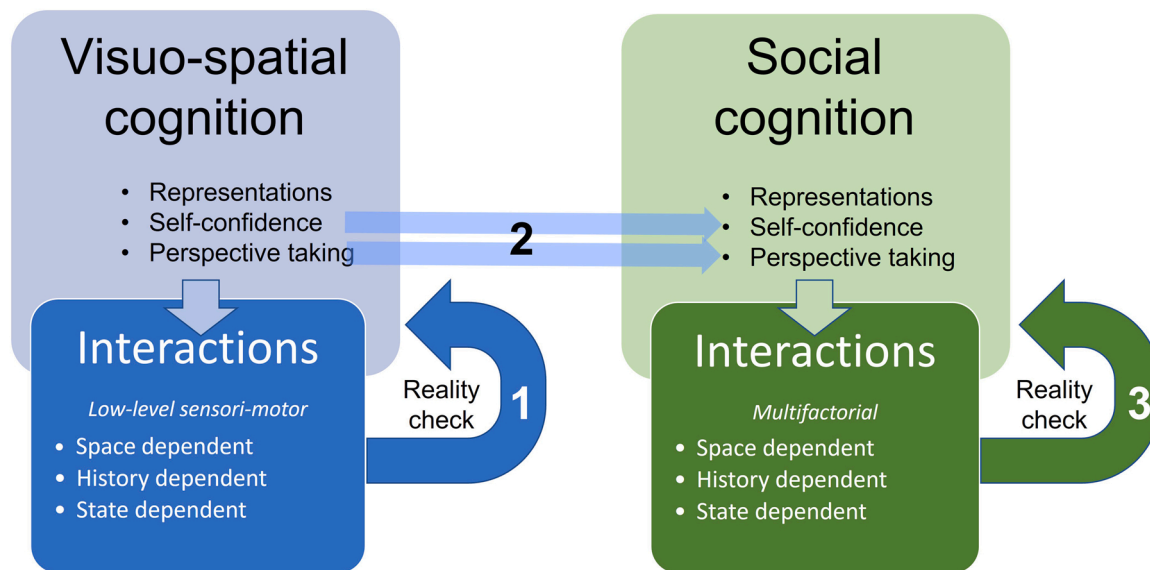
Fig. 1. Every domain of cognition is targeted at interacting with the external world (down-pointing arrows) and is in turn updated by the reality check enabled by these interactions. Our hypothesis is that the embodied reality check resulting from exposure to illusions will update the self-confidence attached to the content of visuo-spatial cognition (arrow 1). In the particular case of 3D ambiguous objects, reality check will moreover favour perspective taking (arrow 1). These updating will then affect self-confidence (and additionally perspective taking in the case of 3D ambiguous objects) in other domains (arrows 2), which may alter social cognition in such a way as to offer more openness to others cognitive and affective point of view (arrow 3).

accuracy of our perception and are convinced that we simply perceive the world "as it is".

The idea that there is an objective reality that is in a one to one correspondence with one's own perception has been characterized as "naive realism" in philosophy (Ross and Ward, 1996). It has been suggested that "naïve realism" expands from the perception of physical objects to the perception of more abstract concepts (e.g. complex social events and political issues, Ishii, 2005; Pronin et al., 2004). This may lead to difficulties in social life, as we expect other reasonable people to perceive the same "reality" as we do (e.g. "he did it intentionally", "there are too many taxes", etc). If we actually see the world as it really is, then, people who have a different view must be biased (Kennedy and Pronin, 2008; Pronin et al., 2004). Exposure to illusions should challenge our - by default - "naive realism" by developing the awareness that our sensory systems do not capture reality. The pedagogical value of illusions on this point is increasingly recognized and put forward in some educational and scientific dissemination fields (e.g. https://knowingneurons.com/visual-illusions-empathy/; https://www.thepathway2success.com/20-strategies-for-teaching-empa thy/; https://www.youtube.com/watch?v=JiTt_hQlN98&t=12s; https:// www.insb.cnrs.fr/fr/cnrsinfo/pourquoi-pensons-nous-que-ce-que-nou s-percevons-correspond-la-realite; https://www.youtube.com/watch? v=Rtsi5PkCh2k; https://serc.carleton.edu/sp/library/interactive/exampl es/48473.html).

Beyond their pedagogical value, a few pioneering experimental studies even suggest that the mere experience gained with simple perceptual phenomena might be spontaneously generalized to more cognitive levels, allowing humans to develop less biased opinions and beliefs about others (Kambara, 2017, 2021). For example, Kambara (2017) demonstrated that exposure to visual illusions enhanced people's awareness of biases in their social judgments. Specifically, participants were simply exposed to three motion illusions (or control images) printed on paper and were then asked to evaluate the extent to which their own and others' social judgements might be influenced by cognitive biases. The results showed that the exposure to illusions not only lead participants to get conscious that their visual perception does not reflect the physical properties of the real-world, but also extended to socio-cognitive judgments (e.g. self-serving attribution for success versus failure). Unlike it was shown for the introspection illusion (Pronin and Kugler, 2007, study 5), Kambara's results show that it was not

necessary to inform participants of the unconscious influence at play during perception. The mere exposure to visual illusions was sufficient to observe this effect. It appears then that illusions do not only represent a pedagogic way to illustrate how cognition is intrinsically biased, but also offer an efficient strategy to change cognition (see Fig. 1 for an illustration). Based on previous bottom-up rehabilitation strategies (e.g. Rossetti et al., 1998; Rode et al., 2006) applied to spatial cognition, we propose that the embodied experience associated with sensorimotor interactions plays powerful influence on cognitive mechanisms. In the case of visual illusions, we propose that the reality check triggered by exposure to visual illusions in general will affect self-confidence in the sensorimotor domain, which may in turn affect other cognitive domains such a social cognition. In addition, when presented adequately, 3D ambiguous objects will strongly boost spatial perspective taking, which may in turn generalize to other cognitive domains and specifically promote perspective taking in the emotional or cognitive domains. In a more general vein, it is noticeable that clinical studies already suggested that sowing the seeds of doubt through an entertaining medium can improve social functioning (Moritz et al., 2014).

Building on the fact that any type of perceptual illusion can lead us to doubt our own perception and question our relation to "reality", we wish to propose that one specific class of illusions, namely those promoting visuo-spatial perspective taking, may produce even more positive outcomes for social interactions. This higher level of awareness concerns the understanding that perception is intrinsically tied to one's point of view and experience. The embodied experience of this law of perception ideally requires seeing an ambiguous object from one point of view and confronting it to another's point of view. Objects recently designed by Sugihara (2015, 2018) (e.g., http://www.isc.meiji.ac.jp/~ko-kichis/Welcomee.html) provide the optimal material for this set-up. Two-dimensional ambiguous figures have been used for centuries by artists and scientists (e.g. Fig. 2 A; Giuseppe Arcimboldo, Utagawa Kuniyoshi, Salvador Dali, Octavio Ocampo, Utagawa Yoshitora,…). In many cases mental rotation may enable the observer to swap between alternative interpretations (Peterson et al., 1992). In sharp contrast to 2D ambiguous figures, Sugihara's creations represent a new class of 3D objects that exhibit different physical properties only when observed from various points of view. As it has been emphasised for surface coding, they offer generic and accidental interpretations (Nakayama and
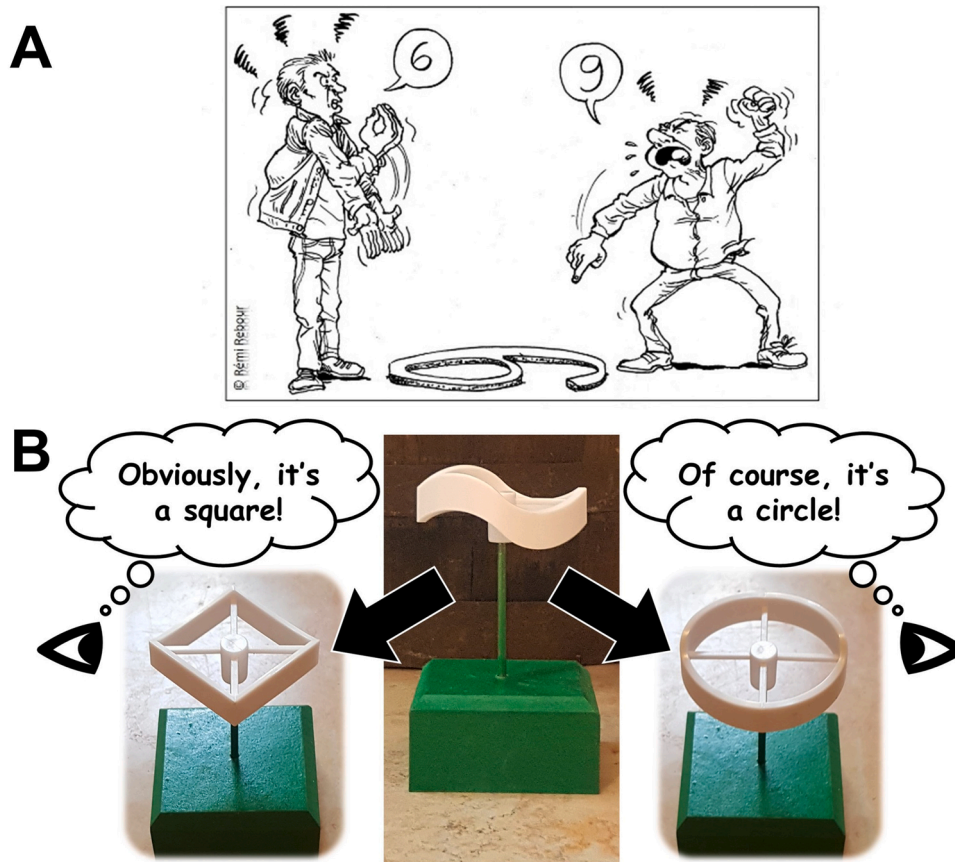
Fig. 2. A. Illustration of the classical 6–9 ambiguity and of the potential impact of ambiguity on human quality of communication. Note that a mere mental rotation enables each viewer to take the perspective of the other. Fig. 2B. Illustration of a 3D ambiguous object created by Sugihara that can be perceived as a square or circle depending of the perspective. In this case mental rotation does not allow the observer to realize that another interpretation of the object is possible.

Shimojo, 1992). Far more interestingly, they offer two radically different, and even incompatible, accidental interpretations when viewed from two specific viewpoints. For instance, one observer may unequivocally see a square while the opposite observer unequivocally sees a circle (see Fig. 2B). In their classical presentation, these objects are presented in a mirror, which allows the observer to embrace two accidental interpretations of reality. Instead of focusing on the outstanding properties of these objects, we have been using them in scientific dissemination events, such that two observers view them with a 180° (Fig. 2B). This leads to incompatible percepts, which incompatibility cannot be resolved by simple mental rotation as it is the case for 2D ambiguous figures, but only by physically moving to the converse viewing point. It is also worth noticing that artists have also created similar, although more complex objects (e.g. Markus Raetz, Triantafyllos Vaitsis, Mathieu Robert-Ortis, Shigeo Fukuda…). The outstanding impact of Sugihara's objects comes from the fact that, unlike numerous art pieces, their interpretation appears to be strongly unequivocal and straightforwardly simple. However, swapping physical points of view after having debated about what each perceived leads to a striking realization: people acquire an embodied experience of changing the very perception (and not only perspective) of a deceptively simple object. They thus realize that any perception of reality is tightly tied to their vantage point. It is noticeable that none of these links and no specific chapters of the Oxford compendium of visual illusions (Shapiro and Todorović, 2017) devote a specific attention to 3D ambiguous figures.

Unlike classical visual illusions, 3D ambiguous objects not only allow us to realize that our perspective is biased but also to literally take the perspective of another person by physically putting ourselves into their shoes and adopting their point of view. It would be extremely powerful if 3D ambiguous objects lead to adopt other's perspectives for representations that go beyond the visuo-spatial domain, as it is the case for the influence of visual illusion on cognition. Over the last century, many theoretical proposals have claimed that high-levels of cognition are directly grounded on lower-level sensory-motor mechanisms (e.g. Piaget, 1936, Barsalou, 2008). Concerning social cognition skills, results show that our ability to understand others' mental states relies on our immediate experience of sensorimotor information in social interactions (Gallese, 2014; Quesque and Coello, 2015). Recent accounts also suggest the existence of a transversal cognitive mechanism for the processing of shared representations in social settings (e.g. Bardi and Brass, 2016; Quesque and Brass, 2019; Sowden and Catmur, 2015). Specifically, the ability to co-represent and switch between self-related and other-related representations would be involved in all socio-cognitive mechanisms, from perceptual to mental-state levels. One might thus expect that an intervention fostering visuospatial perspective-taking also improves perspective-taking for other types of representations. Congruently, recent findings suggest that visuospatial perspective-taking facilitates the access to others' affective states (Erle and Funk, 2022). Specially, the authors showed that emotion identification and emotion intensity judgements about another agent were more accurate after having taken the visuo-spatial perspective of this agent. By helping people to experience that their perception is tied to their vantage point, it might then be possible to improve their ability to realize that it is also the case with their beliefs, knowledge or affective judgements. In this way, by prompting people to consider others' visual perspectives, the exposure to 3D ambiguous objects would favour the consideration of others' beliefs. Consequently, this would increase perceived similarity and liking towards those persons (see Erle and Topolinski, 2017 for an experimental account).

In addition to its intrinsic positive affective value, the use of illusion as a tool to promote social-cognitive abilities presents a substantial advantage: it targets low-level perceptual mechanisms that can be easily used for bottom-up rehabilitation purposes (e.g. Pisella et al., 2006; Rossetti et al., 1998). The use of illusions ensure that therapists are not just training patients to respond to the diagnostic tests, contrasting with current social-cognitive remediation programs which often rely on similar stimuli as those employed for the assessment of social-cognitive abilities (e.g. Turner et al., 2018, for a review on social skills training in psychosis). These clinical considerations further strengthen our convictions regarding the active exposure to illusions, and in particular to 3D ambiguous objects, as interventions to develop perspective-taking as well as experienced proximity between individuals. Having access to broad audience prosocial interventions, easy to implement, and attractive to people, appears to be valuable tool that we predict will become extensively employed.

For the different reasons described above, illusions represent a promising medium to develop perspective-taking and thus may contribute to improving harmony between humans. On this basis, we believe that the use of illusions in psychology in the forthcoming decade should overcome the horizon of research laboratories devoted to the study of perception and be extended to field interventions promoting social cognition and potentially pro-social behavior.

Data availability

No data was used for the research described in the article.

Acknowledgements

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