Self-reference modulates the perception of visual apparent motion

Jianrui Huang[1] &Lihan Chen[1,2] &Xiaolin Zhou[1,3,4]

Accepted: 6 November 2022

Abstract
Visual apparent motion is a perceptual illusion where sequentially presented static stimuli containing no physically continuous motion are perceived as moving. In the current study, we examined whether and how self-reference, as a typical high-level information processing, could modulate perceptual categorization of the apparent motion in Ternus display, even when self-reference is task-irrelevant. Two frames were consecutively presented, with the first frame consisting of two identical stimuli (e.g., two rectangles) on the leftmost and the middle positions and the second frame consisting of two stimuli on the middle and the rightmost positions. Depending on the inter-stimulus interval (ISI) between the two frames, the display could be perceived as showing Element Motion (EM), with the peripheral stimulus moving from one side to the other while the middle stimulus remains stationary or flashes briefly at the middle position, or Group Motion (GM), with both stimuli appearing to move as a whole. Participants were tested in this configuration and then learned to associate different labels (Self, Friend, Stranger) with geometric shapes (C275.10oc a3999996(r)-28207(F)0(r)14.6351.799987792(96(()0(C279.200012207(66)18.799999237(e)-

with each other in different ISIs, resulting in either a dominant EM or a dominant GM percept (He & Ooi, 1999; Petersik & Rice, 2006). Investigating visual apparent motion could help us understand principles of perceptual organization as well as the correspondence problem in which how our visual system establishes correspondence between objects and maintains the identity of the object over time (see Dawson, 1991; Stepper et al., 2020).

Perception of visual apparent motion could be modulated by both bottom-up, stimuli-driven factors and top-down, semantics-driven factors. It has been shown that perception of motion is modulated by spatio-temporal information including inter-stimulus interval, frame duration (see He & Ooi, 1999; Petersik & Pantle, 1979

"Self" is related to all sorts of information an individual holds. Self-referential processing, which can serve as a top-down and semantics-driven factor, has been shown to affect response inhibition (Golubickis et al., 2021

hkape pesentd tieh task (a)16.899999618(s)-263.700012207(t)0(i)minated wen the
accuracy wasbs 90% indicating that the a(s)]TJ 0 -1.2519 TD-.01618 Tc [()-deead;er pser tpatthstask
right or left of the center in the second frame. Following the
stimulus presentation, a question mark appeared in the center of the screen for 1.13 (s) to participants make a forced choice
by pressing a keyboard button (i.e., J or K, counter-balanced across participants) indicating whether they had perceived EM or GM in the current trial. Once a decision had been made, after 300–500 ms, the next trial began. There were ten trials for each combination of label and ISI level, giving 210 trials in total in either the pre-test or the post-test. Trials of different conditions were randomly mixed and presented.

Before the formal experiment, participants completed a 40-trial practice block with only two levels of ISI (50 ms, 260 ms). For the ISI of 50 ms, the display was expected to be perceived as EM; for the ISI of 260 ms, the display was expected to be perceived as GM. Feedback was displayed on the screen if the participant made an incorrect response. After practice, the participant moved on to the formal experiment unless his/her response accuracy was below 90%; in the latter case he/she would repeat the practice block.

The shape-label association tasks

The procedural scheme of shape-label association tasks was adapted from Liu and Sui (2016). In this task, a participant was prompted to establish the one-to-one association between the three personal labels (Self, Friend, Stranger) and three geometric shapes (Circle, Rectangle, Triangle) through associative learning. The shape-label associations were counter-balanced with a Latin square design across participants, and the assignment of participants to the associations was still balanced after the eight participants were eliminated from data analysis. Participants were first told to remember the shape-label associations and then asked to complete a learning task and a matching task to ensure that they had learned the associations well.

In the learning task, each trial began with the presentation of a central fixation cross for 800 ms. Then one shape (triangle, rectangle, or circle, 1.5° × 1.5°, the same as in the Ternus apparent motion task) and three labels in Chinese characters referring to "myself," "good friend", and "stranger" were presented simultaneously above and below the central fixation, respectively. The center of the bottom edge of the shape was 3.2° away from the center of the screen; the three labels appeared 3.2° below the center in random sequence. The participant was asked to judge as quTD [3xall pue (ithin00
, thest ossibhre duratio104.699999809(n)-376.299987792(o)0(f)-703(timulue)11.6snse94.699999809(nratio104.(nr))]TJ 0 -1
of the one three 222.0(o)0(n)15.5(s)-469.100006103(on)-403(th)18.899999618(e)-428.299987792kveyboard (i.e.,,, and
thene, g mil fires-3605.5(o)0(f)-502.200012207(t)0(h)18.899999618(e)-509.700012207(ri)17.299999237(gh)21.2(t)-361.70001220
edb(ac)11(k)-370.700012207(i.aecyncortect reso10481(ons213.9(e,)3675.700012207For)-367.299987792timeFuty) a(s)]T
s/her judgment, and theerl accuracy was displayed at

Results

The shape-label association tasks

For the association learning task, ANOVAs revealed a null effect of label (association) in accuracy, $F(2,74) = .23, p = .80$,

decreased over label conditions in a linear trend (largest in

stimuli with different labels, the task they conducted to test the

Proceedings of the National Academy of Sciences of the United