Reviews (Round 1): The reverse motion illusion in random dot motion displays and implications for understanding development (#7916)

Edited by: Akiyoshi Kitaoka, Ritsumeikan University, Japan

Review by: Shin'ya Nishida, NTT Communication Science Laboratories, Japan

For author and editor

This is an important report that some observers see reversed motion in standard random dot motion displays. The authors reviewed many case reports and then discussed possible underlying mechanisms of the illusion, and potential problems it may cause. Since the illusion takes place only occasionally, it is hard to study systematically, and the manuscript does not provide a clear conclusion about what actually happens. This could be a serious limitation of this manuscript in comparison with the standard scientific reports. I however believe it worthwhile to publish this review and let a wide range of researchers know about the existence of this problem, given the popular use of random dot motion displays in vision science.

Here are some comments for revision.

General: With regard to the organization of the manuscript, I think it better to introduce the potential mechanisms of the reversed motion (as described in section 5) much earlier. If so, readers might be able to understand the cases introduced in sections 2 and 3 more deeply while considering the potential mechanisms of each case, even though it is impossible to identify.

Figure 1: The original figure by Scase et al. (1996) includes other three types of random dot motion displays, which use the signal selection rule “different”, where the same dot can become either signal or noise in different timings. Why are they ignored? In my opinion, the reversed motion might be less common for these types of display than for “same” types, since weaker segregation of noise dots from signal dots (as in the case of the Gaussian motion task) will make induced reversed movements in the noise dots less visible. Is there any evidence for or against this idea?

L272: I like the authors' hypothesis that observers may report the negative motion in the noise dots induced by the strong motion of signal dots in many cases of the reversed motion illusion. It is not particularly surprising that induced motion becomes more visually salient than inducing motion. For example, the effect of Derrington & Henning (1987) may be produced by inhibitory interactions of motion signals across scales (e.g., Serrano-Pedraza et al., 2007, Journal of Vision). According to this view, the majority of observers dominantly perceive induced motion instead of inducing motion. In the case of random dots, noise dots can be more visually salient than coherently moving signal dots, like a singleton target in an otherwise uniform visual search display. Due to such ambiguity in the stimulus, it is possible that some naïve observers report noise motion.

I also think such ambiguity of the random-dot motion stimuli can be significantly reduced by proper choice of stimulus parameters. If the authors have some idea about good stimuli, it would be helpful to readers.

Figure 5: If I understand correctly, the algorithm by Challinor & Mather (2010) computes motion energy only at one spatial scale, and a multiscale model including lower frequency subbands could be more robust against large displacement. This point should be noted.

Recommendation: Revisions Required

Completed: 2021-07-05

Review by: Arthur Shapiro, American University, USA

For author and editor

Review Summary

The article is a review of a curious phenomenon in which participants report perceiving motion in the direction opposite to that presented in random dot motion

displays. The authors are not reporting anything new, but they are pulling together a number of sources to highlight the existence of this phenomenon and to argue that the effect is more widespread than previously thought.

Opinion:

This is not a typical "illusion" article because the phenomenon, though clearly real, is hard to demonstrate. The effect is buried in the data. The irony is not missed on me. Most journals say something like, "nice illusion; where is the data?" Here, I am leaning the other direction: "nice data; where is the illusion?"

However, I could get beyond the lack of observable phenomena if the article were written to direct me towards what is new. If I understand the paper correctly, here is a framework that makes the manuscript appealing to me: a. There have been many reports showing that most observers perceived a reversed motion illusion on a small subset of trials. b. There have been reports of patients with periventricular leukomalacia who regularly perceive reversed motion. c. The authors report that there are children who see reverse motion on almost all trials, even with 100% dot coherence. d. If you look through old studies, there seem to be many of these people, but most studies aren't designed to find them, or aren't emphasizing that reversed motion is a real phenomenon in need of investigation.

I found much of the article to be frustrating to read because I wasn't sure where the article was heading or why; whether the effect was seen by most people on some trials or select people on all trials; or what was new vs. what was an observation from the literature.

I can't recommend the article for publication without major restructuring, but I do think that the phenomenon itself and the context could potentially be interesting to the Journal.

Comments

Page 2, line 37: reverse motion in random dot motion stimuli is perceived by a small proportion of participants.

This phrasing suggests that the phenomenon is an individual difference: "some people see it in the opposite direction." But later on, they cite Bae and Luck as saying, "This reverse motion report occurred on only a minority of trials, but across almost all participants." So, is reverse motion a phenomenon that everybody sees but only on a proportion of trials, or is this individual difference? If I understand the article correctly, it seems that the answer is "both." In some conditions (not specified), most people will report the effect on occasion. However, the authors have three observers (two children with normal vision, and one strabismic adult) who report seeing reversed motion much more frequently. It would be really helpful if the authors could spell this out directly at the beginning of the manuscript.

On page 4, lines 77-79

Barbieri, Topfer, Soch, Bogler & Haynes (2018) is an abstract for a conference presentation, and some of the comments presumably refer to the presentation itself. If so, authors should mention this.

On page 4, starting line 82:

"preliminary evidence of reverse motion reports (as well as reports ±90° from the stimulus direction). Interestingly, these misperceptions of direction" Why are the results preliminary? Why is the +- 90 in parentheses? It seems like a particularly relevant finding. "these misperceptions ..." Which? The antecedent for "these" isn't clear.

P. 4, line 91: "In the binary choice tasks commonly adopted by 91 researchers studying visual development and disorder, it is difficult to determine which 92 incorrect responses are due to reverse motion perception unless the participant happens to describe their percepts, and so this phenomenon may be obscured." This is true. Question: Does the opposite direction phenomenon make the baseline lower than 50%, or are there notable dips in the psychometric curve (not that most curve-fitting procedures would be able to pick up such a dip). (Ah...addressed on line 109 on the next page; might want to reorganize to bring points closer together.)

Line 98: "To our knowledge, these reports have not yet been subject to a systematic investigation, perhaps in part because they reflect only a small percentage of trials."

This is the main theme of the paper. Shouldn't be buried in the middle of a paragraph.

Line 103: "The particular phenomenon we have observed in our own studies, however, is consistent reports of reverse motion perception across trials in a minority of participants, and in some cases, even for stimuli presented at 100% coherence."

This is the main theme of the paper. Should have been introduced earlier.

The transition from line 98 "a small percentage of trials" to line 103 "in a minority of participants...100 coherence" needs to be in the abstract and at the end of the introduction (above line 54). The paper became much more interesting once I understood this.

Line 103: "In an unpublished dataset collected for a Master's thesis (Meier, 2013) 3 of 25 adults 120 experienced reverse motion perception. " If the data are in a nice format, it might be worth showing those unpublished data here.

Paragraph on line 122 seems out of place since I am expecting to hear more about your observers.

The reverse motion illusion in random dot stimuli in children

Section seems out of place. I am expecting to see a little bit more documentation of the effect in adults.

Line 153: Here we present observations from our own studies which show that reverse motion perception is seen in a small proportion of children, including those without any known developmental or vision problems.

Seems like the lead story.

Line 191: (who were siblings). Why is that in parentheses when the info seems important? Siblings showing the same odd behavior could mean a: chance; b: genetic/behavioral connection; or c. since presumably the two patients were tested on the same day, one after each other, one might wonder whether there was something unusual about the testing situation on that particular day. For instance, Frazer &

Wilcox found an effect of motion direction on twins and argued for a genetic origin. But it is possible (Ithink likely) that the finding was due to similar adaptation conditions for the twin pairs.

Figure 3. Needs context. Could you show a comparison of the performance of other children in the same study?

Line 222: “problem” Why is it a “problem”? “Phenomenon,” maybe?

Explanation: Motion induction. The motion induction explanation seems to digress into a motion scission “two competing surfaces” explanation. I am lost.

Explanation: motion energy in the opposite direction. (this explanation seems likely to me)

Line 342: “Bae and Luck (2018) provided preliminary evidence” Can’t leave the reader with this. What was the preliminary evidence? Why was it preliminary?

After this, I lose the thread of the explanations section.

Recommendation: Resubmit for Review

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