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The Paddle Effect in the Pong Task Is Not Due to Blocking Ability of the Observer

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When participants try to block a moving ball on a screen by means of a manually controlled paddle, their perception of the ball's speed is altered as a function of the paddle size and thus of their blocking performance. In particular, the ball appears to move slower the larger the paddle is. This paddle effect was investigated in several studies and has become a prominent example for influences of observers' ability to act on perception. Three experiments were conducted to test for this action-related explanation. The results were clear-cut. The paddle effect occurred even though a possible impact of observers' action ability on perception was experimentally eliminated. This outcome strongly suggests that the paddle effect is not due to action ability as previously assumed.

Public Significance Statement

In contrast to previous research, this study strongly suggests that the ability to block a moving object, such as a ball, does not affect the perception of its speed.

Keywords: perception and action, embodied perception

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Whether an observer's action can affect her or his visual perception is currently intensely debated (e.g., Firestone, 2013; Philbeck & Witt, 2015). Several arguments have been put forward that the reported effects are either not due to genuine changes in perception or are not due to action (Firestone & Scholl, 2016). One of the most thoroughly investigated putative action-specific effects, however, seems to resist all of these objections so far (Witt, 2017b; Witt, Sugovic, Tenhundfeld, & King, 2016). In a task similar to the computer game Pong, participants manually control the movement of one object, referred to as the paddle, trying to block another object, referred to as the ball. Participants report the ball to be moving slower with an increase of the paddle size associated with an increase in blocking performance. This paddle effect has been considered action specific as it apparently indicates an impact of action ability on the perception of speed.[1]

Since the first report by Witt and Sugovic (2010), many attempts have been made to test for alternative explanations. The effect proved to be independent of different judgment procedures and memory processes (Witt & Sugovic, 2012). It is not a result of compliance with experimental demands (Witt & Sugovic, 2013b) and is also observed with indirect action-based measures (Witt & Sugovic, 2013a). It is unaffected by the allocation of spatial attention (Witt, Sugovic, & Dodd, 2016) or by explicit judgment feedback (King, Tenhundfeld, & Witt, 2018), and it is not due to actual action success (Witt, Tenhundfeld, & Bielak, 2017). Moreover, the effect is observed in participants naive to the experiments' hypothesis, and it occurs even when informed participants are asked to resist it (Witt, Tenhundfeld, & Tymoski, 2018).

Given these findings, the paddle effect seems to be a reliable perceptual phenomenon. However, is it really a change in blocking ability of the observer that causes the reported change in speed perception? We examined this question in the present study following a so-called disconfirmatory research strategy as suggested by Firestone and Scholl (2014, 2015, 2016). In particular, we tested whether the paddle effect occurs when its explanation demands that it must not occur. If the paddle effect is in fact due to action ability of the observer, then it should be absent when a possible impact of this factor is experimentally eliminated. Otherwise, the proposed hypothesis would be invalid.

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[1] Please note that all terms relating to action such as "action ability" or "action specific" refer to the action of the perceiver if not otherwise stated. That is, the action ability of the observer has been assumed to be crucial for perception in general and the effect we focused on in the present report in particular. Accordingly, the paddle effect has been assumed to emerge as a consequence of the varying ability of the observer and not, for example, of the perceived ability of the paddle to block the ball.

A similar rationale has already been used in a previous study by Witt and colleagues (Witt, Sugovic, & Taylor, 2012). In that study, participants either played a version of the Pong game or watched a computer playing the game (see Experiment 2 and Experiment 3). Basically, the paddle effect was reduced in the latter as compared with the former condition apparently due to a loss of participants' ability to block the ball. However, this study does not allow drawing strong conclusions because the visual information the participants were exposed to differed substantially between the critical conditions: "When the computer played, the paddle always moved in perfect synchrony with the vertical component of the ball's location, which made it clear that a nonanimate object was playing the game" (Witt et al., 2012, p. 719). Thus, the observed decrease in the paddle effect could be due to differences in the visual input rather than in action ability of the observer (we return to this issue in the Discussion). In the present study, participants also either played a Pong game or watched a computer playing the game. However, to overcome the limitations of the previous approach, we equalized the critical conditions with respect to the visual information the participants received as far as possible.

The goal of Experiment 1 was to replicate the paddle effect combining a version of the Pong paradigm with a classic psychophysical method of constant stimuli. Participants attempted to block a circle (ball hereafter) moving horizontally across the screen by pressing a mouse key to release a rectangle (paddle hereafter), which then moved upward perpendicular to the ball movement. Then a test circle was presented and the participant had to indicate which circle was moving faster (see Figure 1, left part). This procedure is very similar to those used in previous studies in several respects[2] (cf. esp. Witt & Sugovic, 2012, 2013a; Witt et al., 2016).

The goal of Experiment 2 was to test whether the paddle effect occurs when the paddle is no longer under the control of the participant. Here, the paddle was set in motion by the computer based on the data of Experiment 1 so that the visual input was comparable in both experiments. Participants were asked to press a mouse key after the paddle started moving (see Figure 1, middle part). To exclude the possibility that the paddle effect might occur because participants still have the impression of being in control of the paddle, the key press was omitted in Experiment 3 (see Figure 1, right part). If the paddle effect is specific to participants' blocking performance, then it should disappear in Experiments 2 and 3. Otherwise, it should be considered unrelated to the observer's action ability.

Method

Participants

Twelve volunteers participated in Experiment 1. The sample included 10 females and two males ($M_{\text{age}} = 29$, $SD = 10$). Two participants were left-handed. Twelve participants were recruited for Experiment 2. Two of them either misunderstood the task instructions or had difficulty with the task.[3] They were replaced by two new participants. The final sample of Experiment 2 included nine females and three males ($M_{\text{age}} = 27$, $SD = 11$). None of them participated in Experiment 1, and all of them reported to be right-handed. Twelve participants participated in Experiment 3. None of them participated in Experiment 1 or in Experiment 2. The sample included 11 females and 1 male ($M_{\text{age}} = 23$, $SD = 3$). All of them reported to be right-handed. All participants gave their written informed consent for the procedures and received monetary compensation or course credit for their participation. All were naive to the purpose of the experiment and had normal or corrected-to-normal vision. The sample size was determined a priori based on prior research and ensured a power of 0.95 for effect sizes of $\eta_p^2 = .45$ (as estimated from Witt & Sugovic, 2010, 2013a; cf. also Witt et al., 2018).

The study was conducted in accordance with German Psychological Society (DGP) ethical guidelines (2004, CIII), which do not require institutional review board approval for the experiments reported in this article.

Apparatus

The experiments were performed in a dim experimental room. Stimuli were displayed on a CRT monitor (19 in., Samsung Samtron 96 B; Samsung, Seoul, South Korea), with a resolution of 1,024 × 768 pixels and a refresh rate of approximately 100 Hz. One pixel measured about 0.35 mm on the screen. Observers were seated at a distance of 65 cm from the screen with their head supported by a combined chin-and-forehead rest. The middle of the monitor was slightly above the participants' eye level. Participants responded by pressing keys of a computer mouse held in the dominant hand (and arrow keys on a keyboard in Experiment 3 using the nondominant hand).

Stimuli

All stimuli were presented on a gray background (with coordinates "128, 128, 128" in the RGB [red, green, blue] color space). The ball and the test stimulus were dark gray ("81, 81, 81") and were about 15 mm in diameter. The ball initially appeared close to the left edge of the monitor with an edge to the center distance of about 18 mm. Its vertical position randomly varied between 125 mm, 144 mm, and 163 mm with respect to the bottom edge of the monitor. This circle moved linearly along the horizontal to the right. The initial start position of test stimulus was always constant. It appeared in the right upper corner of the monitor with a distance to the right edge of about 18 mm and to the upper edge

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[2] In the original Pong paradigm, participants control the vertical component of the paddle movement with a joystick while the ball is moving along a diagonal sometimes randomly changing its vertical direction. In the present study, the ball moved only horizontally and the participants pressed a key to release the paddle. This simpler version of the Pong task appeared more suitable for the present purposes and was already used previously to demonstrate the paddle effect (Witt & Sugovic, 2013a; Witt et al., 2016). Moreover, the method of constant stimuli was also applied previously in a similar way as in the present study to measure participants' speed perception (Witt & Sugovic, 2012). Also, the velocities we used are well within the range of the previous studies (cf. Witt et al., 2018; Witt & Sugovic, 2013a; Witt et al., 2016). Thus, since the paddle effect is quite robust across several task conditions and the experimental setup of the present study does not substantially differ from those used in the previous studies, there is no obvious reason not to expect the paddle effect in the present setup.

[3] The data of one of them suggested that he judged, contrary to the instruction, which stimulus is slower. Another participant judged the test stimulus as faster in the majority of trials so that fitting of psychophysic functions was not meaningful (the functions did not saturate).

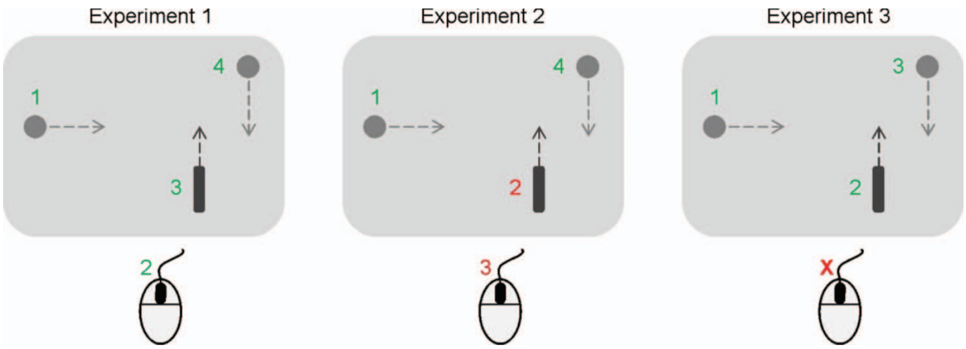

Figure 1. Schematic illustration of the main trial events of the study. Numbers denote the succession of events. In Experiment 1, the ball started moving (“1”); then, the participant pressed the middle key of the mouse to release the paddle (“2”), which then moved upward (“3”). Finally, the test circle moved downward (“4”). In Experiment 2, the mouse key was pressed after the paddle was set in motion by the computer. In Experiment 3, the pressing of the middle mouse key was completely omitted (“X”). See the online article for the color version of this figure.

of about 53 mm. This circle moved down along the vertical. The paddle was a black rectangle of 6 mm width initially presented in a lower right part of the monitor. The distance to the right edge was about 70 mm and the distance from the rectangle’s center to the lower edge about 48 mm. The paddle moved up with a constant velocity of 21 cm/s. Stimulus presentation and recording of participants’ responses were controlled using the E-Prime 2.0 software (Psychology Software Tools, Pittsburgh, PA).

Procedure and Task

Experiment 1. The start of each trial was indicated by a written instruction (“next trial” in German) presented in the middle of the monitor for 500 ms. Then the instruction disappeared, and after the next 500 ms, the ball and the paddle appeared. Following an interval of 300, 400, or 500 ms, the ball began to move. Participants had to press the middle mouse button (mouse wheel) in order to set the paddle in motion. The task was to try to hit the ball by the paddle. If the ball was hit, both objects (i.e., paddle and ball) stopped moving for 500 ms and then disappeared. Otherwise, they continued to move until the ball reached the edge of the monitor. Following an interval of 500 ms in which the display was blank, the test stimulus was presented. After the same interval as for the ball (see above), the test circle began moving and disappeared about 53 mm before the lower edge of the monitor was reached. Then, a question mark was presented, which prompted the participant to judge which circle was faster. The left/right mouse button had to be pressed when the first/second circle was faster. Following an interval of 1,000 ms with a blank screen, a next trial began. When the mouse wheel was not pressed before the ball reached its end position or when the left or the right buttons were pressed before the question mark appeared, an error feedback was presented and the trial was repeated.

Experiment 2. In Experiment 2, participants had to press the mouse wheel as fast as possible after the paddle was set in motion. The onset of the paddle’s motion was based on the reaction times (RT) collected in Experiment 1. In particular, we computed mean RTs for each paddle size and each vertical start position of the ball (see online supplemental Table S1) and then used these values as mean times for the paddle onset in Experiment 2. Additionally, we introduced variability around these values by including standard deviations (*SD*) observed in Experiment 1 and computed across all trials and participants (cf. online supplemental Table S1). That is, the onset of the paddle movement in each trial of Experiment 2 was randomly chosen from the range of values between the mean RT of the respective condition −1 *SD* and the mean RT +1 *SD*. The goal of this procedure was to equalize the mean hitting rates between the experiments (i.e., the visual input) while preventing some simple rigid response strategies. When the mouse wheel was not pressed before the paddle hit the circle or before the ball reached its end position, an error feedback was presented and the trial was repeated. The rest of the procedure was as in Experiment 1.

Experiment 3. Experiment 3 was identical to Experiment 2 with the following changes. Participants were not required to press the mouse wheel. Instead, they were asked to report whether the paddle had hit the ball at the end of each trial. This judgment was prompted by a written instruction (“collision or not?” in German) and was made by pressing the upper (for collision) or lower (for no collision) arrow key on the keyboard. When the judgment was wrong, an error feedback was presented and the trial was repeated.

Design

The ball served always as the standard stimulus and moved with a constant velocity of 35 cm/s. The velocity of the test stimulus varied from 20% to 180% with respect to the velocity of the standard stimulus in nine steps. That is, the test stimulus moved with 7, 14, 21, 28, 35, 42, 49, 56, or 63 cm/s. The length of the rectangle varied between 11 mm (“small paddle”), 30 mm (“medium paddle”), and 70 mm (“big paddle”). There were thus 27 critical experimental conditions that were randomly presented. The main experiments included five blocks of trials with 81 trials each. Before the main experiments started, participants performed 10 practice trials that were not included in the analysis.

Data analysis.

For each participant and each paddle size, we computed the proportion of trials in which the test stimulus was judged as moving faster than the ball as a function of the test velocity. These values were then fitted with a psychometric function using a local model-free fitting procedure, and the point of subjective equality (PSE) was determined (Żychaluk & Foster, 2009). We also report the just noticeable differences (JNDs), which were calculated by identifying the test velocities corresponding to the 25% and 75% thresholds and then halving the difference between these values. Note that because we used the ratio of test to standard velocity for analyses, the JNDs correspond to the Weber fractions. Accordingly, these values indicate a change in stimulus velocity (in ratio units) that could reliably be detected by the participants. Also, the proportion of trials in which the paddle hit the ball was determined. These values were statistically analyzed using SPSS software (Version 23; IBM Corp., Armonk, NY). Analyses of variance (ANOVAs) were performed by including paddle size as a within-subjects factor and, in case of data analyses across experiments, experiment as a between-subjects factor. The raw data have been made publicly available (https://osf.io/fvntu/).

Results

Experiment 1

The ball was hit more often the larger the paddle was, $F(2, 22) = 701.4$, $p < .001$, $\eta_p^2 = .985$ (see the left part of the upper row in Figure 2 for means). Mean proportions of trials in which the test stimulus was judged as faster are shown in the middle row of Figure 2 (left; see also online supplemental Figure S1 for individual values). The PSE shifted to the left (i.e., toward lower test velocities) with an increase in paddle size as expected, $F(2, 22) = 11.1$, $p < .001$, $\eta_p^2 = .502$. The ball was judged to be 8.2% slower when a large rather than a small paddle was used (see the left part of the lower row in Figure 2 for means). The magnitude of the effect and its size are well in line with previous reports (cf., e.g., Witt & Sugovic, 2010; Witt et al., 2018).

The mean JNDs amounted to .16 (*SD* = .05), .17 (*SD* = .06), and .16 (*SD* = 0.5) for the big, medium, and small paddles, respectively, and were not significantly different from each other, $F(2, 22) = .2$, $p = .832$, $\eta_p^2 = .017$.

Experiment 2

The rate of collisions between the paddle and the ball increased with an increase in paddle size as intended, $F(2, 22) = 528.8$, $p < .001$, $\eta_p^2 = .980$ (see the middle part of the upper row in Figure 2). As compared with Experiment 1, there was a slight increase in the overall hitting rate, $F(1, 22) = 8.2$, $p = .009$, $\eta_p^2 = .272$. The influence of paddle size on the rate of collisions did not interact with experiment, $F(2, 44) = 2.1$, $p = .133$, $\eta_p^2 = .088$. Critically, the ball was again judged to be slower with an increase in the size of the paddle (see the middle parts of the lower and the middle rows in Figure 2 and online supplemental Figure S2 for individual values), $F(2, 22) = 4.8$, $p = .019$, $\eta_p^2 = .303$. The effect amounted to 7.3% and was not significantly different from the effect observed in Experiment 1, $F(2, 44) = .6$, $p = .574$, $\eta_p^2 = .025$. Also, the overall PSE did not differ between Experiments 1 and 2, $F(1, 22) = .1$, $p = .779$, $\eta_p^2 = .004$.

The JNDs did not differ significantly across the paddle conditions, $F(2, 22) = .3$, $p = .756$, $\eta_p^2 = .025$, as well as between Experiments 1 and 2, $F(1, 22) = .01$, $p = .927$, $\eta_p^2 < .001$ (main effect of experiment) and $F(2, 44) = .5$, $p = 636$, $\eta_p^2 = .020$ (interaction). The mean values in Experiment 2 were .17 (*SD* = .06), .16 (*SD* = .06), and .16 (*SD* = .05) for the big, medium, and small paddles, respectively.

Experiment 3

The rate of collisions was higher the larger the paddle was, as expected, $F(2, 22) = 813.6$, $p < .001$, $\eta_p^2 = .987$. Also, there was a slight increase in the overall hitting rate, $F(1, 22) = 12.2$, $p = .002$, $\eta_p^2 = .357$, and no significant interaction between paddle size and experiment, $F(2, 44) = 2.0$, $p = .147$, $\eta_p^2 = .084$, when the data of Experiment 3 and Experiment 1 were analyzed within a single ANOVA. Importantly, the paddle effect was again evident in velocity judgments, $F(2, 22) = 11.8$, $p < .001$, $\eta_p^2 = .518$. The ball was judged to be 7.3% slower when a large compared with a small paddle was used (see the right part of the lower and the middle rows in Figure 2 and online supplemental Figure S3 for individual values). The effects of paddle size on velocity judgments as well as the overall PSE did not differ between Experiments 3 and 1, $F(2, 44) = .074$, $p = .929$, $\eta_p^2 = .003$ and $F(1, 22) = .2$, $p = .670$, $\eta_p^2 = .008$, respectively.

The mean JNDs in Experiment 3 amounted to .14 (*SD* = .04), .17 (*SD* = .07), and .15 (*SD* = 0.5) for the big, medium, and small paddles, respectively, and were not significantly different from each other, $F(2, 22) = 1.5$, $p = .250$, $\eta_p^2 = .118$. Also, these values did not differ from the values observed in Experiment 1, $F(1, 22) = .2$, $p = 673$, $\eta_p^2 = .008$ (main effect of experiment) and $F(2, 44) = .2$, $p = 785$, $\eta_p^2 = .011$ (interaction).

Discussion

A target object is perceived as moving slower when the size of another manually controlled object used to block the target object increases. The previous research suggested that this paddle effect is due to changes in observers' blocking ability. The goal of the present study was to test this assumption. In Experiment 1, the paddle effect was replicated. In Experiments 2 and 3, a possible impact of action ability was eliminated while the impact of other variables was kept highly comparable. The results were clear and straightforward. The paddle effect was observed even though the participants were unable to act upon the critical object. This outcome strongly suggests that the origin of the paddle effect is not related to an observer's action ability as previously assumed.

The paddle effect has already been examined using disconfirmatory research strategies. One experimental logic was to demonstrate the absence of the paddle effect when the paddle size does not affect ball-blocking performance (Witt & Sugovic, 2012; Witt et al., 2012; cf. Witt, 2017b). Another approach was to reduce the control over the action and to show a decrease in the paddle effect (Witt, 2017a). Both strategies, however, do not allow distinguishing between action-related and action-unrelated explanations. Since the performance is experimentally manipulated, the critical conditions substantially differ with respect to the visual input,

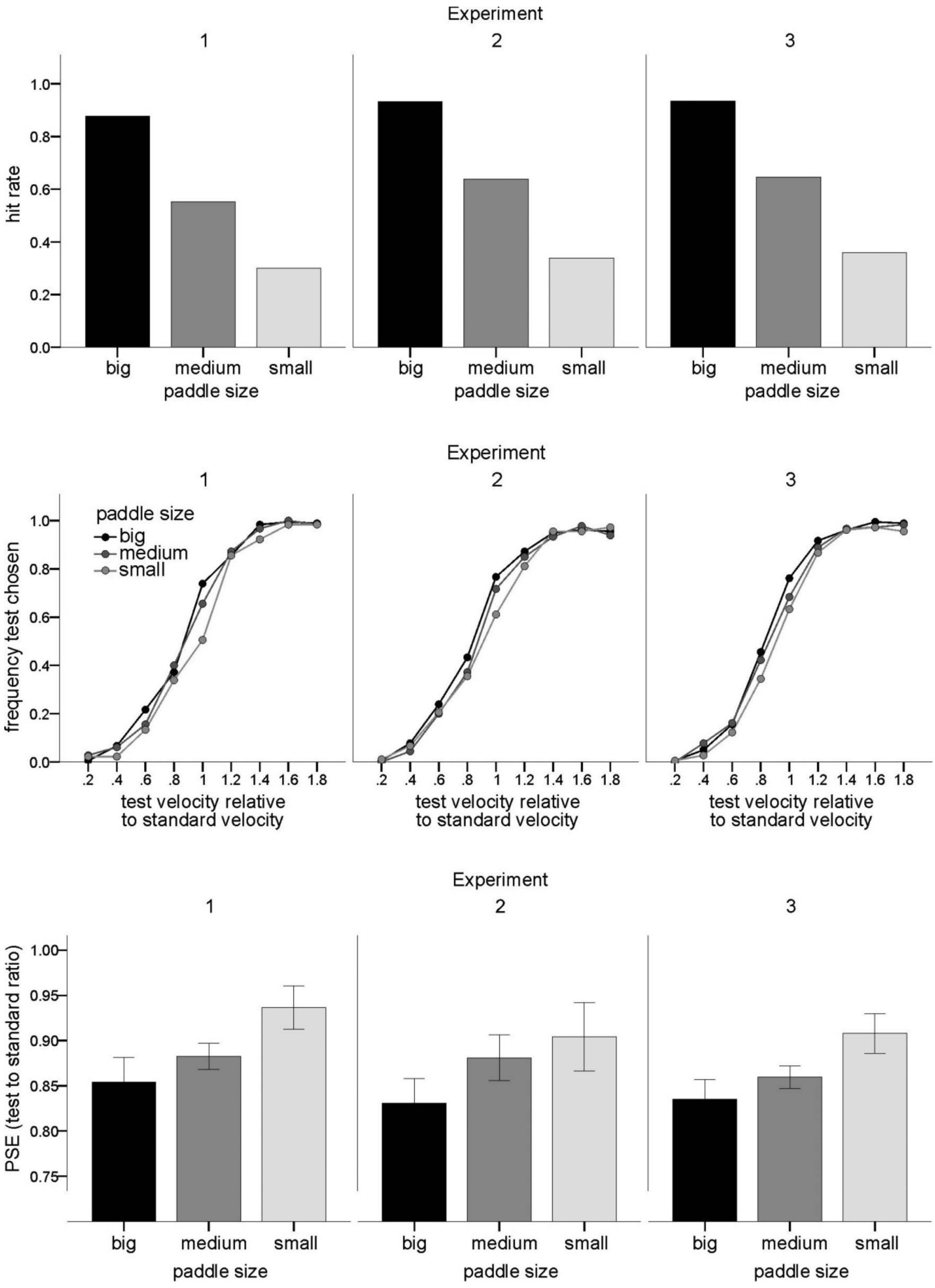

Figure 2. *Upper row:* The mean frequency of collisions between the paddle and the ball for each experiment and each paddle size. *Middle row:* The percentage of trials for the small, medium, and large paddle in which the test stimulus was judged as faster as a function of the velocity of the test stimulus. *Lower row:* The mean point of subjective equality values for each paddle size. Error bars indicate within-participants confidence intervals (95%) computed according to Cousineau (2005).

especially with respect to the frequency of collisions. Consider, for example, that the ball typically stops moving and remains visible thereafter for a while when it is hit, whereas it usually disappears at the edge of the screen when it is missed. The smaller speed judgment in the former compared with the latter condition could thus reflect the lower average speed of the ball. Thus, any changes in the paddle effect observed previously might be due to changes in the processing of the varying visual input. This suspicion is supported by the fact that the paddle effect is present even when observing another person doing the Pong task (Witt, South, & Sugovic, 2014; Witt et al., 2012).

In conclusion, the results of the present study suggest that the paddle effect observed in the Pong-like tasks is not due to action ability of the observer. This indicates that some other factors are responsible for the observed modulation in speed perception. Identifying such factors could be an avenue worth taking for future research.

References

Cousineau, D. (2005). Confidence intervals in within-subject designs: A simpler solution to Loftus and Masson's method. *Tutorials in Quantitative Methods for Psychology, 1,* 42–45. http://dx.doi.org/10.20982/tqmp.01.1.p042

Firestone, C. (2013). How "paternalistic" is spatial perception? Why wearing a heavy backpack doesn't—and couldn't—make hills look steeper. *Perspectives on Psychological Science, 8,* 455–473. http://dx.doi.org/10.1177/1745691613489835

Firestone, C., & Scholl, B. J. (2014). "Top-down" effects where none should be found: The El Greco fallacy in perception research. *Psychological Science, 25,* 38–46. http://dx.doi.org/10.1177/0956797613485092

Firestone, C., & Scholl, B. J. (2015). Can you experience 'top-down' effects on perception? The case of race categories and perceived lightness. *Psychonomic Bulletin & Review, 22,* 694–700. http://dx.doi.org/10.3758/s13423-014-0711-5

Firestone, C., & Scholl, B. J. (2016). Cognition does not affect perception: Evaluating the evidence for "top-down" effects. *Behavioral and Brain Sciences, 39,* e229. http://dx.doi.org/10.1017/S0140525X15000965

King, Z. R., Tenhundfeld, N. L., & Witt, J. K. (2018). What you see and what you are told: An action-specific effect that is unaffected by explicit feedback. *Psychological Research, 82,* 507–519.

Philbeck, J. W., & Witt, J. K. (2015). Action-specific influences on perception and postperceptual processes: Present controversies and future directions. *Psychological Bulletin, 141,* 1120–1144. http://dx.doi.org/10.1037/a0039738

Witt, J. K. (2017a). A role for control in an action-specific effect on perception. *Journal of Experimental Psychology: Human Perception and Performance, 43,* 1791–1804. http://dx.doi.org/10.1037/xhp0000447

Witt, J. K. (2017b). Action potential influences spatial perception: Evidence for genuine top-down effects on perception. *Psychonomic Bulletin & Review, 24,* 999–1021. http://dx.doi.org/10.3758/s13423-016-1184-5

Witt, J. K., South, S. C., & Sugovic, M. (2014). A perceiver's own abilities influence perception, even when observing others. *Psychonomic Bulletin & Review, 21,* 384–389. http://dx.doi.org/10.3758/s13423-013-0505-1

Witt, J. K., & Sugovic, M. (2010). Performance and ease influence perceived speed. *Perception, 39,* 1341–1353. http://dx.doi.org/10.1068/p6699

Witt, J. K., & Sugovic, M. (2012). Does ease to block a ball affect perceived ball speed? Examination of alternative hypotheses. *Journal of Experimental Psychology: Human Perception and Performance, 38,* 1202–1214. http://dx.doi.org/10.1037/a0026512

Witt, J. K., & Sugovic, M. (2013a). Catching ease influences perceived speed: Evidence for action-specific effects from action-based measures. *Psychonomic Bulletin & Review, 20,* 1364–1370. http://dx.doi.org/10.3758/s13423-013-0448-6

Witt, J. K., & Sugovic, M. (2013b). Response bias cannot explain action-specific effects: Evidence from compliant and non-compliant participants. *Perception, 42,* 138–152. http://dx.doi.org/10.1068/p7367

Witt, J. K., Sugovic, M., & Dodd, M. D. (2016). Action-specific perception of speed is independent of attention. *Attention, Perception, & Psychophysics, 78,* 880–890. http://dx.doi.org/10.3758/s13414-015-1047-6

Witt, J. K., Sugovic, M., & Taylor, J. E. T. (2012). Action-specific effects in a social context: Others' abilities influence perceived speed. *Journal of Experimental Psychology: Human Perception and Performance, 38,* 715–725. http://dx.doi.org/10.1037/a0026261

Witt, J. K., Sugovic, M., Tenhundfeld, N. L., & King, Z. R. (2016). An action-specific effect on perception that avoids all pitfalls. *Behavioral and Brain Sciences, 39,* e261. http://dx.doi.org/10.1017/S0140525X15002563

Witt, J. K., Tenhundfeld, N. L., & Bielak, A. A. M. (2017). Dissociating perception from judgment in the action-specific effect of blocking ease on perceived speed. *Attention, Perception, & Psychophysics, 79,* 283–297. http://dx.doi.org/10.3758/s13414-016-1222-4

Witt, J. K., Tenhundfeld, N. L., & Tymoski, M. J. (2018). Is there a chastity belt on perception? *Psychological Science, 29,* 139–146. http://dx.doi.org/10.1177/0956797617730892

Żychaluk, K., & Foster, D. H. (2009). Model-free estimation of the psychometric function. *Attention, Perception, & Psychophysics, 71,* 1414–1425. http://dx.doi.org/10.3758/APP.71.6.1414

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