

# Looking ahead: Attending to anticipatory locations increases perception of control

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**Question: Is there a relationship between visual attention and the perception of control?**

## Introduction

Theory of apparent mental causation:

Perceived control over an action is more likely when thoughts about the action precede the action (Wegner, 2002; Wegner & Wheatley, 1999).

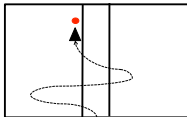
Attention and Control?

When thinking about an action, we may also attend to its goal; perhaps spatial attention mediates the perception of control.

**Hypothesis: Observers will feel more control over an object when we direct their attention to where the object is headed.**

## Method

**Boat Control Task:** Participants attempted to steer a boat (~0.8 deg triangle) for 5 sec to keep it centered in the face of invisible waves that knocked it to the left and right as it steadily drifted upwards. Two vertical lines ~5 deg apart were also shown.



**Color Task:** Participants reported the color (red or blue) of a 200 ms flash that appeared at a random time in the trial.

**Boat Motion:**

Each key press moved the boat left or right at ~5 deg/s for 170 ms. Steering performance was recorded as the average deviation from the center.

Wave strength varied across trials, moving boat horizontally at ~5 deg/s (Weak Waves), ~20 deg/s (Medium Waves), and ~40 deg/s (Strong Waves). Wave direction varied randomly (left, right, none) and changed every 150 ms.

**Perception of Control Rating:**

Participants rated their perceived level of control after each trial on a 9-point scale (1=lowest, 9=highest).

## References

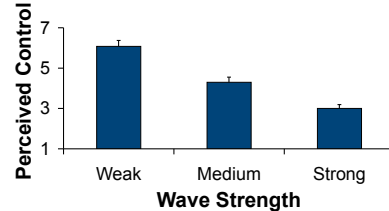
Wegner, D. M. (2002). *The illusion of conscious will*. Cambridge, MA: MIT Press.  
Wegner, D. M., & Wheatley, T. (1999). Apparent mental causation: Sources of the experience of will. *American Psychologist*, 54(7), 480-492.

**Experiment 1: Does drawing visual attention to where the boat is going influence perception of control?**

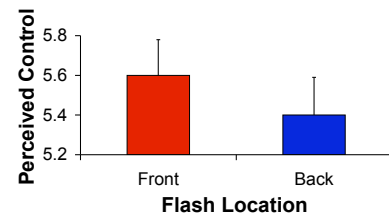
Participants steered boat under two flash conditions:

● **Front Flash:** Flash appeared ~1 deg in front of boat, drawing attention to where boat was headed.

▲ **Back Flash:** Flash appeared ~1 deg behind boat, drawing attention to where boat had been.



•Participants felt decreasing control over the boat as wave strength increased ( $F(2, 22)=108, p<0.001$ ).



•Flash location did not influence steering performance (Front  $M=5.4$  deg,  $SD=0.7$  deg; Back  $M=5.5$ ,  $SD=0.6$ ;  $p>0.1$ ).

•Participants felt more in control of the boat when the flash appeared in front of it ( $F(1, 11)=7.9, p<0.02$ ).

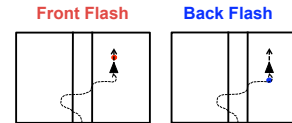
Observers feel more control over an object when their attention is drawn to a location where the object is headed than where the object has already been.

**Visual attention influences perception of control.**

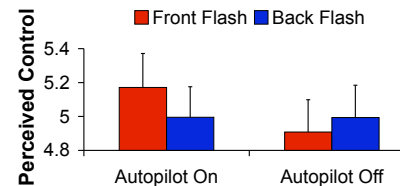
**Experiment 2: Does moving the boat to an attended location influence perception of control?**

Participants steered boat and discriminated flash color under two autopilot conditions:

**Autopilot On:** Boat moved in straight line towards/away from flash, regardless of participants' key presses. The autopilot initiated when the flash appeared and continued for 400 ms.



**Autopilot Off:** Boat moved based on wave strength and participants' key presses throughout trial, as in Exp. 1.



•Neither flash location (Front  $M=4.9$  deg,  $SD=0.5$  deg; Back  $M=4.8$ ,  $SD=0.4$ ;  $p>0.1$ ) nor the autopilot function (Auto On  $M=4.8$ ,  $SD=0.5$ ; Auto Off  $M=4.9$ ;  $SD=0.4$ ;  $p>0.1$ ) influenced steering performance.

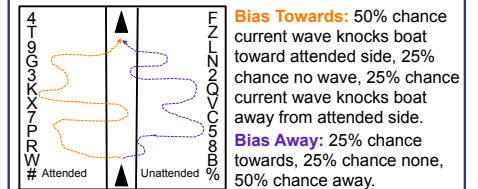
•Participants felt more in control of the boat when the flash appeared in front of it, but only when the autopilot steered the boat directly over the flash location ( $F(1, 19)=5.8, p<0.03$ ).

Observers feel more control over an object when the object moves over a location where they are attending.

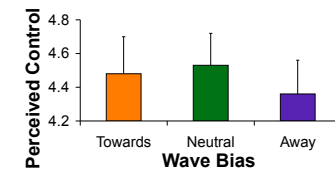
**Perception of control increases when objects move to attended locations.**

**Experiment 3: What is the influence of biasing the boat's motion toward an attended side?**

Participants steered boat and attended to one of two upward drifting RSVP streams under three wave bias conditions:



**Bias Neutral:** 33% chance towards, 33% chance none, 33% chance away.



•Away bias hurt steering performance (Towards  $M=4.8$  deg,  $SD=0.4$  deg; Away  $M=5.0$ ,  $SD=0.6$ ;  $t(15)=-3.1, p<0.01$ ).

•Participants felt less control over the boat when it was biased to move away from the attended side ( $F(2, 30)=5.5, p=0.01$ ).

Observers experience decreased perception of control over an object and steer it less accurately when the object is biased to move away from a continuously attended area.

**Control decreases when objects move away from attended locations.**

## Conclusions

Observers feel more in control of an object when it goes to where they are attending.

The theory of apparent mental causation extends to visual attention.

If an object goes where we are looking, we are more likely to feel like we made it go there.