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The relation between the sense of agency and the experience of flow

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ABSTRACT

This article investigates the relation between people's feelings of agency and their feelings of flow. In the dominant model describing how people are able to assess their own agency—the comparator model of agency—when the person's intentions match perfectly to what happens, the discrepancy between intention and outcome is zero, and the person is thought to interpret this lack of discrepancy as being in control. The lack of perceived push back from the external world seems remarkably similar to the state that has been described as a state of flow. However, when we used a computer game paradigm to investigate the relation between people's feelings of agency and their feelings of flow, we found a dissociation between these two states. Although these two states may, in some ways, seem to be similar, our data indicate that they are governed by different principles and phenomenology.

1. Introduction

Gallagher (2007, p. 348) defined the sense of agency as "the pre-reflective experience or sense that I am the cause or author of the movement (e.g., an experience that I am in control of my action)". For example, if I reach to pick up a glass, I may actually have a sense of control over the movement and so have a sense of agency for this movement; if I am then asked, did I reach for the glass, I can correctly attribute agency to myself: 'Yes, I was the one who reached for the glass.'

Cognitive models have made considerable progress in pointing to the informational basis for such feelings of control. The most widely accepted computational model addressing this question is the comparator model (Blakemore, Frith, & Wolpert, 1999; Wolpert, Ghahramani, & Jordan, 1995). This model was initially proposed to solve the problem of how people are able to achieve fast, finely-tuned and flexible online control of movements. Wolpert and colleagues (Wolpert & Flanagan, 2001; Wolpert et al., 1995) proposed that the actual sensory feedback of movement is compared to its predicted feedback. When a discrepancy between the predicted and actual feedback occurs, it can be used to immediately correct the movement. But the comparison can also be co-opted for other purposes: Blakemore, Frith and others (Blakemore & Frith, 2003; Blakemore, Wolpert, & Frith, 1998; Blakemore et al., 1999) proposed that this comparison information could serve as the basis for people's sense of agency. When a large discrepancy at the locus of convergence for the actual and predicted feedback (the comparator) is detected, it means that there was a large difference between the person's intentions and what happened and therefore that the person was not in control. In contrast, when there is little to no difference between the two signals, it

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means that the person's intentions are being smoothly actualized, and the person is in control. The smoothness that sometimes accompanies and is a cue for the positive sense of agency—where the person's intentions play out without apparent opposition from the outside—is highly reminiscent of the reports that people give when they are experiencing a state of effortless flow.

A common model describes feelings of flow as a function of skills and task demands. When the task demands match the actor's skills, people are prone to experience flow. When demands exceed skills, people become anxious. They become bored when they are too skilled for the current demands (the *balance* hypothesis, Csikszentmihalyi, 2009; Rheinberg & Vollmeyer, 2003). Recently, this model was augmented to include people's judgments of performance. Flow judgments are highest when skills and demands are in balance *and* when they think they are performing well (the *balance plus* hypothesis; Kennedy, Miele, & Metcalfe, 2014).

The experience of flow is reported across a range of activities, including sports, music, mountaineering, painting, and gaming, and is described as a pleasurable and motivating immersion in the current activity (Csikszentmihalyi, 2009; Massimini & Carli, 1988). The flow state is similar to the heightened state of consciousness that is sometimes, especially in sports, described as a feeling of being in the zone, or having a "hot hand" in basketball (Gilovich, Vallone, & Tversky, 1985; Young & Pain, 1999). In the literature, the terms zone and flow are often used interchangeably (Young & Pain, 1999), and we do so here as well. Crucially, when the person is 'in the zone' or in a state of flow, there is a feeling of effortlessness, and lack of resistance from the world. For instance, Roger Bannister, in describing his four-minute mile breaking run says: "Brasher went into the lead and I slipped in effortlessly behind him. My legs seemed to meet no resistance, as if propelled by some unknown force" (Bannister, 2014). Similarly, Hales (1999, p. 79) reported that when five time Wimbledon champion, Björn Borg, was at the height of his powers, he described the feeling that he "could do anything—put the ball on a dime at any angle, anywhere on the court, at any speed he chose, with the spin he wanted." Note that Borg's description emphasizes precise control over his actions and their outcomes; this sense of control is considered an important characteristic of the flow state (Nakamura & Csikszentmihalyi, 2002).

There have been no studies in which the relation between agency and flow has been explicitly tested. However, Wenke, Fleming, and Haggard (2010, and see Chambon & Haggard, 2012; Chambon, Sidarus, & Haggard, 2014; Sidarus, Chambon, & Haggard, 2013; Stenner et al., 2014) investigated the effect of subliminal priming of actions on people's feelings of agency. They found that the increases in action selection fluency due to such priming resulted in increases in people's sense of control over the effects of their action. Wenke et al. (2010, p. 36) noted: 'Our key finding is that this smoothness produces a heightened sense of control. This is in keeping with the notion that during a well-learned, skilled task such as playing the piano, people often report mastery of what they are doing, and a feeling of "flow" (Csikszentmihalyi, 2000).'

Although the previous considerations suggest similarities between flow and agency, there also may be important differences between these two states. For instance, the relationship between experienced control and the flow state is sometimes called paradoxical (Young & Pain, 1999). Flow requires control over actions, but is thought to also involve a loss of awareness of oneself as a (social) actor (Nakamura & Csikszentmihalyi, 2002, p. 90), suggesting that these two experiences might not be the same.

The hypothesis that motivated the present study was that there would be convergence between people's sense of agency and feelings of flow. We began with the findings of Kennedy et al. (2014) who demonstrated that the feeling of flow can be manipulated by having participants play a computer game in which X's and O's scroll from the top of the screen, and the participants' task is to move a mouse controlling a cursor in such a way as to catch the X's while avoiding the O's. They varied the speed of the scroll, and found a non-monotonic relation between people's feelings of flow and speed. People tended to experience the highest levels of flow at moderate speeds—speeds at which they were maximizing the number of X's that they hit over the 20 s game interval. Less flow was experienced when the speed was either too high or too low. People also experienced an increase in flow when they had the metacognitive feeling that their performance was particularly good on that trial (regardless of whether their performance actually had been particularly good). Kennedy et al. (2014), did not look at agency judgments. However, the computer game that they used has been used in other studies that have investigated people's feelings of agency (see, Metcalfe, Eich, & Castel, 2010; Metcalfe, Eich, & Miele, 2013; Metcalfe & Greene, 2007; Metcalfe, Snellenberg, DeRosse, Balsam, & Malhotra, 2012; Miele, Wager, Mitchell, & Metcalfe, 2011). In the first experiment that we present here, we simply took exactly the same game that Kennedy et al. (2014) had used, but instead of asking people for judgments of flow (what Kennedy et al. called 'Z' scores), on each trial, we asked them for judgments of agency (how in control they felt). Our expectation was that we would obtain agency functions that were virtually identical to those reported for flow by Kennedy et al. (2014).

2. Experiment 1

2.1. Method

2.1.1. Participants

The sample of 14 participants (3 males and 11 females, M_{age} = 20 years) were students in an Introductory Psychology course at Columbia University and received partial course credit for their participation. All participants were treated in accordance with APA regulations, and the ethical guidelines of the Psychonomic Society.