

Conscious Will and Responsibility

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CHAPTER 12

Bending Time to One's Will

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During the course of a day, a person might perform hundreds of actions and observe countless events. Even before sitting down for breakfast, it is possible to scramble eggs, put bread in the toaster, pour cream into coffee, and whistle a duet with the friendly bird outside. While performing these and other actions, one's senses are bombarded with information about surrounding events: eggs curdling, cream swirling in coffee, a squirrel leaping past the bird, ruffling its feathers and song, the local news reporting on a house fire, and . . . is that the smell of burning toast? Despite all these channels on the mind's TV, one usually has little difficulty keeping track of the events for which one is, and is not, responsible. How does the mind pull off this nifty feat? What factors does it consider when determining authorship for events, and what does this experience of authorship *feel* like?

Time is an important factor in determining authorship. If one comes across an empty soda can in the road and gives it a good kick, the typical empty soda can response is to take off without hesitation, skid for a bit, and arrive at a new resting place somewhere down the road, a little worse for the journey. Under these circumstances, one would experience an unmistakable sense of authorship for the can's movement, and perhaps a touch of pride ("I did that"). But what if, upon receiving the kick, the can just stood there for a minute (wondering, maybe, how it got into this situation), and only after this delay did it make the trip down the road? It is a safe bet that one's experience of authorship would be diminished, along with any pride.

For physical events, causes are usually followed soon after by their effects (Michotte, 1963), and so the mind expects one's actions to be followed promptly by the events they cause. Any gap between action and event therefore lessens the feeling of having caused the event—making temporal proximity one of the most important indicators of authorship. But this is only half the story. Just as perceiving a brief delay between action and event can lead to a determination of authorship, a determination of authorship can lead to perceiving a brief delay between action and event (Haggard, Clark, & Kalogeras, 2002). Consider, again, the person who approaches a soda can and gives it a kick. Ordinarily, a split-second later the can would fly forward through the air, and personal authorship for the can's movement would be inferred. Now, imagine instead that a split-second after the kick, the streetlight turned on. Delusional individuals aside, most people would dismiss this as coincidence and not infer authorship. We proposed that, with authorship more plausible for the can's movement than for the light's turning on, the delay between kicking and the can's moving would *feel* briefer than the delay between kicking and the light's turning on. The logic is thus: The mind knows that causes are temporally bound to their effects, and so when authorship is inferred, the perception of time is warped to match this inference, such that one's action and inferred effect are perceived to be especially close in time.

This dual proposal that perceived temporal proximity of actions and events is both a key

indicator of authorship and a significant part of its phenomenology ultimately rests on the work of Benjamin Libet, whose discoveries challenged two long-held, commonsense views: first, that conscious will causes actions; and second, that the conscious experience of time is objective, with events perceived as they happen and without filter. Building on the research of Libet and others, we first show that conscious will, and authorship more generally, is less a cause of events than an *experience* one has when the mind determines an event should be ascribed to the self—and that time plays a key role in such determinations. We then show that this experience of authorship involves a subjective bending of time, such that actions and events are perceived to be temporally closer to each other when authorship is inferred.

CONSCIOUS WILL AND THE INFERENCE OF AUTHORSHIP

In an experiment by Libet, Gleason, Wright, and Pearl (1983), participants were asked to voluntarily choose when to move their finger, and then report the position of a dot on a clock face when they first were aware of intending to move. On each trial, scalp recordings monitored cerebral activity for a readiness potential (RP) known to precede voluntary actions. This RP was found to precede finger movements by at least 550 ms—a finding that by itself is not surprising, as brain activity of *some* kind had to cause the fingers to move. However, it was also found that participants' conscious intentions preceded the finger movements by a mere 200 ms or less—placing conscious intentions several hundred ms *after* the start of the RP. In other words, brain activity involved with preparing the act began hundreds of ms before any hint of willing the act appeared in the person's conscious experience. As Libet et al. (1983) wrote, "the brain evidently 'decides' to initiate or, at the least, prepare to initiate the act at a time before there is any reportable subjective awareness that such a decision has taken place" (p. 640).

For those believing that conscious will causes action, this was bad news. Conscious will, supposed to be the initiator of voluntary behavior,

the Prime Mover of the mind, was found to *trail*—and by quite a substantial margin—brain activity known to trigger voluntary behavior. A straightforward interpretation of these results is that unconscious processes drive behavior, with conscious thought merely coming along for the ride. This view is the starting point for the theory of apparent mental causation.

Apparent Mental Causation

Wegner and Wheatley (1999) and Wegner (2002) offered a theory of apparent mental causation—beginning with the idea that conscious will is an experience, akin to sensing the color red or feeling joy on a spring day. This experience arises from interpreting one's thought as the cause of an action, independent of whether or not such a causal link actually exists. The notion that conscious will is independent of causal forces was suggested by the existence of motor automatisms, such as Ouija-board spelling, and certain neuropsychological disorders, such as alien hand syndrome, in which seemingly voluntary actions feel unwilled and unintended. Because the experience of conscious will appears separable from the processes that cause action, how the mind creates this experience requires its own explanation.

Drawing on Michotte's (1963) research on how people perceive causality for physical events, Wegner and Wheatley (1999) hypothesized that conscious will should be strongest when one's thought: a) is consistent with an action (consistency); b) occurs before the action (priority); and c) is not accompanied by other potential causes of the action (exclusivity). So, if one thinks about kicking a soda can right before doing so, and no one else is around to tug on one's leg, the act of kicking should feel strongly willed. Several experiments have examined how consistency, priority, and exclusivity affect the experience of will; let us consider some evidence for each.

Consistency

An experiment by Wegner and Wheatley (1999) found that participants who were primed with a thought (e.g., the word "swan" spoken over headphones) that was consistent with a subsequent

action (e.g., stopping a computer mouse such that the cursor landed on a swan) felt as though they had willed the action—even though the action had been caused by someone else (a confederate of the experimenter) (see also Aarts, Custers, & Wegner, 2005; Pronin, Wegner, McCarthy, & Rodriguez, 2006; Wegner, Sparrow, & Winerman, 2004).

Priority

In this same experiment, the timing of the consistent prime in relation to the action was found to matter for the experience of will. When the prime occurred 5 s or 1 s before the action, participants reported that they had willed the action; in contrast, when the prime occurred 30 s before or 1 s after the action, participants reported that the action felt unwilled. For a thought to enhance the experience of will, it must therefore occur immediately prior to the action (see also Wegner et al., 2004).

Exclusivity

An experiment by Wegner, Fuller, and Sparrow (2003) found that participants who pressed keys to answer a series of easy yes-no questions attributed much of their correct responding to another person whose hand was placed atop their own. Participants had been instructed to “read the unconscious muscle movements” this person made after each question and to press the keys according to these subtle movements. In actuality, the other person was a confederate who could not hear the questions—meaning that participants attributed their own answers to the influence of someone who could not have possibly helped. So, even though participants were fully responsible for their actions, their experience of will was undermined by the presence of another plausible cause (see also Wegner & Sparrow, 2007).

Libet Revisited

It is safe to assume that participants in Libet et al.’s (1983) experiment felt their actions to be consciously willed. On each trial, they experienced an action-consistent thought (“I want to move my finger!”) just prior (by about 200 ms) to moving their finger, and no alternative causes

of this action were readily apparent. This conjunction of thought and action happened over and over again, without exception. Faced with such evidence, participants might reasonably have concluded that their conscious intention to move their finger *caused* the finger to move.

But what is reasonable is not necessarily true. Though the conscious intention that appeared prior to acting may have provided a helpful preview of the action to come (Wegner, 2008), the decision to act was made earlier, by a process outside of conscious awareness.

Authorship Processing

The theory of apparent mental causation describes how actions and thoughts are linked to the self, and is therefore one part of a more general description of authorship processing, “the set of mental processes that monitors indications of authorship to judge whether an event, action, or thought should be ascribed to self as a causal agent” (Wegner & Sparrow, 2004, p. 1201). To feel as though one has personally authored an external event (e.g., a soda can’s traveling down the road), the event must be causally linked to an action one performed (e.g., kicking the can), ideally an action that felt willed (e.g., a kick performed freely and with forethought).

To determine authorship for events, the mind again relies on the trusted indicator’s consistency, priority, and exclusivity. So, feelings of authorship for an event should be greatest when the event is consistent with one’s immediately prior action and has no other potential causes. One would thus have strong feelings of authorship for a soda can’s trip down the road if the can traveled in a direction consistent with one’s kick, which was performed just prior to the can’s movement, with the kick’s exclusivity as a potential cause unchallenged by the presence of, say, a strong wind or that meddling squirrel again.

BENDING TIME

We have seen how the mind relies on certain indicators, including the briefness of the delay between one’s action and an event, to determine authorship. But what if the link between

indicators and authorship is bidirectional? What if, upon determining that an event was authored by oneself, certain authorship indicators are accentuated, including the briefness of the delay between action and event? This notion, far-fetched at first glance, gains plausibility when one considers research on: a) the subjective antedating of sensory experience (Libet, 2004; Libet, Wright, Feinstein, & Pearl, 1979); b) the "idealized" perceptions that occur during authorship processing (Preston & Wegner, 2005); and c) a recently discovered phenomenon known as "intentional binding" (Haggard et al., 2002).

Subjective Antedating of Sensory Experience

Libet et al. (1979) discovered that it can take up to 500 ms of activation in the sensory cortex before one becomes consciously aware of a sensory signal—yet one does not experience this delay. Instead, the subjective experience seems to be "antedated" to around the time when the signal first arrived at the cortex. Libet (2004) gave the example of driving a car down a city street when, suddenly, a boy runs in front of the car. In this situation, it is possible to brake quickly—perhaps in as little as 150 ms—to avoid hitting the boy. But conscious awareness of the boy takes longer—perhaps as much as 500 ms—indicating that any decision to brake must be made entirely unconsciously. But because subjective experience is antedated, the driver consciously perceives the boy first, the brakes being applied second—even though the boy does not reach conscious awareness until *after* the brakes are applied.

These findings imply that the sense of time is both subjective and reconstructive, with the mind reordering events as needed to preserve causal priority and provide a coherent description of the world in conscious awareness—prerequisites for a mental system that temporally binds actions and effects together in consciousness. Moreover, a related finding that the perception of an event may be altered by a subsequent event occurring up to 500 ms later (Libet et al., 1979) suggests the existence of a brief window during which the perceived timing of one's action may be altered by its effect.

Authorship and Idealized Perceptions

It may be that the experience we have of authoring our actions is part of a mental system that constructs an ideal causal account of action. Preston and Wegner (2005) proposed that humans see themselves as ideal agents for whom thought, will, and action are always aligned with each other and with achieving optimal outcomes. In a given situation, any one of these components may be absent or difficult to detect, but because we idealize our own agency every component is nevertheless perceived to be present. So, when will and action are present, thought is inferred (intention confabulation); when thought and action are present, will is inferred (apparent mental causation); and when thought and will are present, action is inferred (action misperception).

Most relevant for present purposes is action misperception. Preston and Wegner (2003) conducted an experiment in which participants fired foam bullets from a toy gun at a target 10 ft away, and were asked to judge how close they came to hitting the bull's-eye after each shot. Thought was manipulated on different trials by projecting onto the bull's-eye the face of a famous person who was either widely disliked (e.g., Adolf Hitler) or widely liked (e.g., Mahatma Gandhi). Conscious will, which had been found to be greater when a countdown was provided prior to action, was manipulated by having the experimenter either count down to firing ("3–2–1–Go!") or not ("Go!"). Controlling for actual distance from the bull's-eye, participants judged their shots to be more on-target when given a countdown and firing at a disliked face. These results suggest that when a determination of authorship is made, the mind engages in a bit of perceptual trickery, exaggerating authorship indicators in the service of maintaining one's image as an ideal agent. In reality, the bullet might have grazed Hitler's uniform, but to the person pulling the trigger, the bullet found its mark.

Given this penchant for authors to subjectively rewrite history, it wouldn't be surprising to find that individuals also perceive actions and their effects as closer in time when personal authorship is implicated. In the scenario just described, the time between when the trigger is

pulled and the bull's-eye is hit should feel briefer if the target is Hitler than if it is Gandhi, all else equal, because the sense of authorship is greater in the first case.

Intentional Binding

A straightforward way to test for temporal binding of actions to effects is to examine their perceived timing. Haggard et al. (2002) conducted a clever experiment, based on Libet's time judgment paradigm (Libet et al., 1983), in which participants were told to press a key when they felt the urge to do so, and an auditory tone was played shortly after they acted. Participants were asked to judge, in separate blocks, either the time of their keypress or the time of the subsequent tone, by referring to a clock hand.

The main results showed that participants' judgments of when their action occurred were shifted forward in time (toward the tone), while judgments of when the tone occurred were shifted backward in time (toward the action), relative to judgments made in baseline blocks where action and tone occurred alone. Critically, these perceptual shifts did not occur when transcranial magnetic stimulation (TMS) was used to induce the participant to make an involuntary keypress, suggesting that binding happens only for voluntary actions. Calling this phenomenon "intentional binding," Haggard et al. (2002) proposed that the "brain contains a specific cognitive module that binds intentional actions to their effects to construct a coherent conscious experience of our own agency" (p. 385).

Since then, several experiments have supported this view, while suggesting that binding is sensitive to two different kinds of authorship indicators: those that are internal to the individual and involved in controlling actions and predicting their effects (Blakemore, Wolpert, & Frith, 2000; Haggard & Clark, 2003), and those that are external to the individual and retrospective in nature, such as characteristics of the event occurring after one's action (Moore & Haggard, 2008). Demonstrating the importance of internal, predictive indicators, it has been found that binding is weak (Engbert, Wohlschläger, Thomas, & Haggard, 2007) or nonexistent (Engbert, Wohlschläger, & Haggard, 2008) when

observing another person's finger pressing a key, or when one's own finger is involuntarily made to press a key by a motor attached to the key (Engbert et al., 2008). Demonstrating the importance of external, retrospective indicators, it has been found that under circumstances in which actions are unreliably followed by tones, an action is perceived as shifted forward in time only when the tone does occur—information that can be known only after the fact (Moore & Haggard, 2008). That binding is sensitive to a variety of authorship indicators supports the hypothesis that when the mind infers authorship for an event, it also shapes the perception of action and event, such that they seem temporally closer.

TESTING THE AUTHORSHIP-BINDING LINK

Still, evidence for this authorship-binding link has been indirect. Previous research has not administered corroborating measures of perceived authorship, so it isn't clear that temporal binding occurs alongside the experience of authorship. Moreover, key authorship indicators, such as the degree of consistency between actions and events, have not been manipulated to examine their effects on binding. Seeking a more direct test of the hypothesis, we conducted a series of experiments (Ebert, 2008; Ebert & Wegner, 2010) examining binding in relation to previous research on authorship processing. In each experiment, participants performed actions that were followed a brief while later by events. Across experiments, various authorship indicators were manipulated, and their effects on both binding and self-reported authorship were measured. In some experiments we also included measures of clinically relevant variables known to involve a distorted sense of authorship, such as depression, to see if they would predict binding effects.

If the authorship-binding hypothesis is correct, indicators that affect the sense of authorship should affect binding in similar ways, and clinically relevant variables should moderate these effects. For instance, consider the degree of consistency between actions and events. After kicking a can, it might obligingly shoot forward

in the same direction as one's foot (consistent event), or it might careen wildly off course, landing, say, in the bed of a passing truck (inconsistent event). Authorship for the can's movement should be greater when this movement is consistent with one's action, and binding should be greater as well. What about someone who is depressed, though? To the extent that depressed individuals generally have low expectations that their actions will bring about successful outcomes ("Knowing me, when I kick this can it'll probably veer off and hit somebody's passing car"), among depressed participants, whether an event is consistent or inconsistent with one's action should matter little for one's experience of authorship and binding.

The Push/Pull Paradigm

Our research was conducted within a naturalistic "push/pull" paradigm, in which participants experienced action-event sequences that resembled those they might encounter in their daily lives, such as pulling on a door handle and watching the door open, or pushing a ball and watching it go away. The acts of pulling and pushing are imbued with bodily significance (Niedenthal, Barsalou, Winkielman, Krauth-Gruber, & Ric, 2005), implying both an orientation toward whatever is acted upon and a specific expected outcome of the action. Pulling corresponds to an approach orientation toward an object and is undertaken with the expectation that the object will come closer, whereas pushing corresponds to an avoid orientation and is undertaken with the expectation that the object will move away (Cacioppo, Priester, & Berntson, 1993; Chen & Bargh, 1999). Because the push/pull paradigm simulates everyday actions and events, we believe results obtained with it are of relatively high external validity.

In each experiment, participants completed a series of trials on which they saw a picture of an everyday object (e.g., an apple) and pushed or pulled on a joystick in response. This action was followed by a brief delay (in most experiments, 100 ms, 400 ms, or 700 ms), after which the object appeared to move either away from or toward the participant (the event). Participants then estimated the length of the delay between

their action and the object's movement, and these interval estimates served as the measure of binding (see Engbert et al., 2008; Engbert et al., 2007; Moore, Wegner, & Haggard, 2009). Participants also reported the degree to which they felt that their action had caused the object to move, which served as the measure of authorship.

The authorship indicators that were manipulated and the clinically relevant variables that were measured are now described, along with key results for each.

Manipulated Authorship Indicators

Across several experiments, a variety of authorship indicators were manipulated to examine their effect on binding. Specifically, we manipulated whether the object moved in the same direction as the participant's action (action-event consistency), whether participants pulled for desirable objects and pushed for undesirable ones (thought-action consistency), and whether participants freely chose to push or to pull (free choice).

Action-Event Consistency

If, upon being kicked, a soda can moves forward in the same direction as one's foot, the experience of authorship should be greater than if the can veers off to the side. Almost by definition, one of the strongest indicators of authorship is whether or not an event is consistent with one's prior action. Although what is considered consistent is likely to vary as a function of the individual's current situation and past experience with actions and their outcomes (Wegner & Sparrow, 2004), our research took advantage of a natural kind of consistency that exists between certain actions and events. Specifically, after pushing in response to an object, a consistent event would be the object's moving away (and an inconsistent event would be the object's moving closer), whereas after pulling, a consistent event would be the object's moving closer (and an inconsistent event would be the object's moving away).

In several experiments, we found that participants judge the delay between consistent actions and events to be briefer than the delay between inconsistent actions and events (Ebert, 2008; Ebert & Wegner, 2010). These effects of consistency on

binding were mirrored by large effects of consistency on self-reported authorship; in addition, in most of these experiments, the more consistency increased a given participant's self-reported authorship, the more it increased his or her binding.

When asked at the end of the experiment whether they felt that the delay was briefer for trials on which the object moved in the same direction as their action, briefer for those on which the object moved in the opposite direction, or if it made no difference, many participants said that the delay felt briefer when the object moved in the same direction. In other words, participants reported some awareness of the effect consistency had on binding, presumably because the effect was big enough that over the course of the experiment participants noticed that the delay for consistent trials felt briefer. Critically, a regression analysis indicated that the effect of consistency on binding would have obtained even if subjects had been completely unaware of it (cf. Greenwald, Klinger, & Schuh, 1995)—that the effect does not *depend* on participants' awareness.

Thought-Action Consistency

Thinking about kicking the soda can before doing so—compared to, say, thinking about how much one likes soda—should lead to greater feelings of authorship when the can speeds away. Several experiments have demonstrated the importance of thought-action consistency for the experience of authorship (Aarts et al., 2005; Wegner et al., 2004; Wegner and Wheatley, 1999), but ours was the first to test whether this authorship indicator affects binding (Ebert, 2008). In this experiment, thoughts were manipulated by presenting participants with either a normatively desirable object (e.g., a slice of pizza) or undesirable object (e.g., a moldy strawberry) on each trial. It was assumed that desirable objects would generally trigger thoughts about pulling, whereas undesirable objects would trigger thoughts about pushing. Actions were manipulated independently of thoughts by cueing participants on each trial either to push or to pull. Thus, half the trials involved thought-action consistency (pulling for desirable objects

or pushing for undesirable objects), and half involved inconsistency (pushing for desirable objects or pulling for undesirable objects).

Unexpectedly, thought-action consistency was not found to significantly increase either self-reported authorship or binding in the sample overall. However, across participants the correlation between authorship and binding effects was positive and significant. In other words, among those for whom thought-action consistency did increase authorship, it also increased binding—again suggesting a link between feelings of authorship and binding. The lack of any main effects of consistency might have owed to the cued nature of actions performed in this experiment. Critical for the experience of authorship may be the sense that one is freely choosing how to act.

Free Choice

If one freely chooses to kick the soda can, the experience of authorship should be greater than if one is ordered to do so. To fully own an action and its consequences, the actor must be the one calling the shots; indeed, authorship is greatest under conditions of free choice, and diminished when one's actions are dictated by another (Milgram, 1974; Wegner & Sparrow, 2004).

To examine the effects of choice on binding, we conducted an experiment with two counter-balanced blocks, one in which participants were cued how to act on each trial (i.e., a prompt appeared telling them whether to push or to pull), and one in which they were prompted to choose (Ebert, 2008). We found that participants judged the delay between actions and events to be briefer under conditions of free choice. A regression analysis indicated that this effect of choice on binding did not depend on participants' awareness of the effect (cf. Greenwald et al., 1995).

Somewhat surprisingly, no effect of choice was found for self-reported authorship. Though this null result could indicate that there are circumstances in which an authorship indicator may affect binding without affecting authorship, we offer a different explanation: the authorship measure we used was ill-suited for detecting an effect of choice. This measure, with its wording

focused on the mechanical, causal link between action and event, is not geared toward aspects of authorship having to do with intentionality (“I wanted the object to do that”) or personal responsibility (“I’m responsible for what happened to the object”)—aspects on which freely chosen actions differ the most from cued actions.

Delay between Action and Event

As we discussed earlier, authorship should be greatest when a soda can moves right after it is kicked. In accord with past research (Michotte, 1963; Wegner et al., 2004; Wegner & Wheatley, 1999), our experiments have indeed found that briefer delays between action and event lead to an increase in self-reported authorship for the event (Ebert, 2008; Ebert & Wegner, 2010). Unfortunately, the nature of the push/pull paradigm is such that it is difficult to assess the effect of delay on binding, and delay was not manipulated for this purpose. However, previous research using other methods has found that delay is a key moderator, with greater binding effects observed at briefer delays (Haggard et al., 2002). It is therefore worth noting that in our experiments examining action-event consistency, the greatest effects of consistency on binding were found at the briefest delays (Ebert, 2008; Ebert & Wegner, 2010). In fact, these effects were nonsignificant at the longest delay examined (700 ms)—in line with Libet et al.’s (1979) suggestion that there is at most a 500-ms window during which the conscious perception of an event may be altered by a subsequent event. Self-reported authorship, on the other hand, *was* affected by action-event consistency at the longest delay, suggesting that self-reports and binding measure unique aspects of authorship (Ebert & Wegner, 2010).

Summary of Authorship Indicators Results

Across several experiments, the presence of key authorship indicators was found to increase binding. In addition, these indicators (with the exception of free choice) were found to increase self-reported authorship, and their effects on self-reported authorship were often correlated with their effects on binding. These findings

provide some of the strongest evidence yet linking binding to authorship. Because the results were obtained within the naturalistic push/pull paradigm, they also bolster claims about the external validity of binding effects.

Clinically Relevant Variables

When all goes well, the mind considers a variety of authorship indicators, presumably in proportion to how diagnostic they are, to arrive at a reasonably accurate judgment about whether an event should be attributed to the self. But several clinically relevant tendencies are marked by a distorted sense of authorship—too much or too little—including depression, narcissistic personality, and schizotypal personality. Could it be that individuals exhibiting a distorted sense of authorship overweight or underweight particular authorship indicators, leading them to take credit for events that they did not author or to dismiss those that they did?

To address this question, we looked at whether depression, narcissistic personality, and schizotypal personality would moderate the effects of authorship indicators on binding (Ebert, 2008). Here, we focus on the correlations obtained between each of these clinically relevant variables and the effect of action-event consistency on binding. A positive correlation between a given clinically relevant variable and this binding effect would suggest that those exhibiting the clinical tendency are relatively sensitive to action-event consistency, whereas a negative correlation would suggest relative insensitivity to consistency. Such correlations would thus help to explain, in terms of sensitivity to a key authorship indicator, why certain clinical tendencies are accompanied by heightened or diminished feelings of authorship.

Each of the clinically relevant variables is now described, along with any correlation that was found with the effect of action-event consistency on binding.

Depression

Experiencing a loss of control is one of the core symptoms of depression (American Psychiatric Association, 1994), and the prominent learned helplessness theory traces depression to the

individual's belief that he or she is powerless to overcome negative circumstances (Seligman, 1975). Likewise, depressed individuals have low expectations that their actions will lead to successful outcomes, and may even come to expect outcomes inconsistent with their actions (Alloy & Abramson, 1979; Aarts, Wegner, & Dijksterhuis, 2006). When a depressed individual kicks a can, authorship should not vary much as a function of what the can does next, whether it flies forward in a straight line or dribbles awkwardly into the gutter.

It was therefore predicted that relatively depressed individuals (as measured by the Beck Depression Inventory-II; Beck, Steer, & Brown, 1996) would be insensitive to action-event consistency and exhibit weaker effects of this indicator on binding. In fact, this was what we found in one experiment (Ebert, 2008). It is worth noting that, because events were consistent with actions only half the time in the context of this experiment, a rational case could be made for *not* expecting a consistent event. Thus, the behavior of relatively depressed participants was in keeping with the view that depressed individuals have a soberingly realistic sense of agency in situations marked by low control (Alloy & Abramson, 1979).

Narcissistic Personality

A narcissistic personality is characterized by exaggerated feelings of power and self-efficacy (DSM-IV). In this sense, narcissism is the opposite of depression, with narcissistic individuals expecting their actions to lead to successful outcomes—and perhaps dismissing inconsistent outcomes as having not been caused by them. When a narcissistic individual kicks a can, authorship should be high if the can's movement is consistent with the kick ("Look—just as I had planned!") and low if it is inconsistent ("Who did *that*?").

It was therefore predicted that relatively narcissistic individuals (as measured by the 37-item version of the Narcissistic Personality Inventory; Emmons, 1987), would be particularly sensitive to action-event consistency and exhibit stronger effects of this indicator on binding. This prediction was borne out in one of our experiments (Ebert, 2008).

Schizotypal Personality

Individuals with schizophrenia may experience two kinds of distorted authorship, one in which they attribute the consequences of their own actions to others, and one in which they experience authorship over events they did not cause (Haggard, Martin, Taylor-Clarke, Jeannerod, & Franck, 2003). Both distortions might be traceable to deficits in awareness of one's intended actions, awareness that normally arises as part of a predictive "forward model" when actions are planned and carried out (Franck et al., 2001; Frith, 1992; Blakemore et al., 2000). In our research, we examined schizotypal personality, a nonclinical manifestation of some of the same tendencies found in schizophrenia. When a schizotypal individual kicks a can, he or she may have only a faint idea of what the can will do next, and so authorship should not vary as a function of how the can moves.

It was predicted that, due to a deficit in anticipating the outcomes of their actions, relatively schizotypal individuals (as measured by the Schizotypal Personality Questionnaire-Brief; Raine & Benishay, 1995) would be insensitive to action-event consistency and exhibit weaker effects of this indicator on binding. The results of one of our experiments supported this prediction (Ebert, 2008).

Summary of Clinically Relevant Results

Individuals who scored high on certain clinically relevant variables known to involve a distorted sense of authorship were found to be particularly over- or under-sensitive (depending on the variable) to a key authorship indicator. Specifically, relatively depressed individuals exhibited weak effects of action-event consistency on binding, whereas relatively narcissistic individuals exhibited strong effects—suggesting that the former have lower expectations that their actions will lead to consistent events than do the latter. Relatively schizotypal individuals exhibited weak effects of action-event consistency on binding, perhaps owing to a deficit in anticipating the outcomes of their actions.

Though suggestive, these results should be interpreted with caution. First, participants were

sampled from a nonclinical, student population, so generalizing the results to individuals diagnosed with Major Depressive Disorder, Narcissistic Personality Disorder, or schizophrenia would be premature (at the same time, one could argue that sampling from a nonclinical population restricts the range of the clinically relevant variables, thereby *underestimating* the true correlation between each of these variables and binding). Second, it is not clear whether the observed abnormalities in binding are *causes* of the clinical tendencies, or instead effects. In the case of relatively depressed individuals, the observed lack of binding for consistent events could, on the one hand, contribute to their sense of personal inefficacy ("It just didn't feel like I caused the object to come toward me when I pulled"); on the other hand, a sense of personal inefficacy could be the reason they do not expect their actions to lead to consistent events ("When I pulled, I didn't expect the object to come toward me"), which would diminish binding for such events.

To address these issues, future research could sample from clinical populations and examine sensitivity to a wider range of authorship indicators, and longitudinal studies could follow at-risk individuals over time to disentangle which came first: the distorted sense of authorship or the abnormality in binding.

CONCLUSION

Much is to be gained by focusing on the temporal aspects of authorship. Nearly three decades ago, Libet and colleagues found evidence that conscious will may not cause behavior, by showing that behavioral intentions arrive in consciousness only after unconscious brain activity has set things in motion (Libet et al., 1983). The unconscious causes of one's behavior may remain inscrutable to conscious awareness, but the mind does its best to figure out which events one has authored, and for good reason: Accurate authorship processing enables individuals to evaluate the results of their actions and adjust future behavior accordingly, to discriminate between events that have been caused by themselves rather than by others, and to take

responsibility for the consequences of their actions (Wegner & Sparrow, 2004).

The mind appears to make determinations of authorship through a process of causal inference, looking for clues that indicate whether an event should be attributed to the self as causal agent (Wegner, 2002; Wegner & Sparrow, 2004; Wegner & Wheatley, 1999). A key authorship indicator is the temporal proximity between thoughts, actions, and events. Specifically, actions feel willed when they follow on the heels of a consistent thought (Wegner & Wheatley, 1999), and events feel authored when they occur right after a consistent action (Wegner & Sparrow, 2004).

But the link between temporal proximity and authorship appears to go both ways: When the evidence warrants an inference of authorship, one's action and the event are perceived as temporally closer than they otherwise would be. The discovery of "intentional binding"—a shift in the perceived timing of voluntary actions and subsequent events in the direction of each other—first suggested this possibility (Haggard et al., 2002). We have since conducted a series of experiments to further test the hypothesis that binding is a part of the experience of authorship (Ebert, 2008; Ebert & Wegner, 2010).

These experiments employed a naturalistic paradigm, in which action-event sequences resembled those one might encounter in everyday life: flexing and extending one's arm in response to graspable objects, and watching those objects come closer or move away, are basic and common occurrences. Key authorship indicators, such as action-event consistency, were manipulated across experiments, and their effects on self-reported authorship and binding were assessed. In general, these authorship indicators were found to affect binding and self-reported authorship in similar ways. Moreover, the degree to which these indicators affected binding was meaningfully correlated with clinically relevant variables known to involve a distorted sense of authorship.

Together, the results of our experiments support the hypothesis that binding occurs when authorship is inferred—that the mind, in a sense, bends time to one's will.

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