

Bias versus bias: Harnessing hindsight to reveal paranormal belief change beyond demand characteristics

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Abstract:

Psychological change is difficult to assess, in part because self-reported beliefs and attitudes may be biased or distorted. The present study probed belief change, in an educational context, by using the hindsight bias to counter another bias that generally plagues assessment of subjective change. Although research has indicated that skepticism courses reduce paranormal beliefs, those findings may reflect demand characteristics (biases toward desired, skeptical responses). Our hindsight-bias procedure circumvented demand by asking students, following semester-long skepticism (and control) courses, to recall their precourse levels of paranormal belief. People typically remember themselves as previously thinking, believing, and acting as they do now, so current skepticism should provoke false recollections of previous skepticism. Given true belief change, therefore, skepticism students should have remembered themselves as having been more skeptical than they were. They did, at least about paranormal topics that were covered most extensively in the course. Our findings thus show hindsight to be useful in evaluating cognitive change beyond demand characteristics.

Psychology and its allied disciplines have long struggled to accurately assess change, whether that ostensible change results from maturation, senescence, laboratory experimental manipulations, psychotherapeutic techniques, community interventions, or educational programs (see, e.g., Cronbach & Furby, 1970; Hertzog & Nesselrode, 2003; Lord, 1956, 1967; Nesselrode, Stigler, & Baltes, 1980; Rubin, 1974). Of course, in contexts in which the desired change is entirely subjective—as is the case with attitudes, beliefs, cognitions, evaluations, or emotional states—the risks of misidentifying or misinterpreting change will only increase, since subjects' self-reports may be biased, distorted, or erroneous (see, e.g., Conway & Ross, 1984; Festinger, 1957; Greenwald, Spangenberg, Pratkanis, & Eskenazi, 1991; Hoogstraten, 1979; Kirsch, 1985; Lewinsohn & Rosenbaum, 1987; Loftus, 1979; H. Markus & Kunda, 1986; Orne, 1962; Wilson & Brekke, 1994). Researchers must therefore develop statistical and methodological tools to help discriminate real from illusory change. The present study demonstrated a seemingly paradoxical approach, whereby a powerful cognitive bias was strategically deployed as a means to counter another, especially formidable bias that plagues assessment of subjective change—here, in the context of an educational intervention designed to affect undergraduates' beliefs.

Education and Paranormal Belief

Most Americans, even many with advanced educational degrees, hold paranormal, superstitious, or pseudoscientific beliefs, such as belief in extrasensory perception (ESP), alien abduction, or creationism (Moore, 2005; Newport & Strausberg, 2001; Rice, 2003). Indeed, neither general science knowledge nor a scientific major consistently hinders such beliefs (Aarnio & Lindeman, 2005; Goode, 2002). Limited research suggests, however, that university courses that directly and skeptically examine paranormal and pseudoscientific phenomena may reduce students' beliefs in them, at least in the short term.

Unfortunately, this literature is limited in both size and methodological rigor. Of the dozen or so published studies on educational interventions and paranormal belief, only three included control groups (students in unrelated courses; see Dougherty, 2004; Gray, 1985; Morier & Keeports, 1994);¹ furthermore, some studies included only postcourse evaluations with no pre-to-post comparisons (Broch, 2000; Calvin, 2009), and most studies asked students to report their beliefs without anonymity (Banziger, 1983; Emme, 1940; Gilliland, 1930; Jones & Zusne, 1981; McBurney, 1976; Swords, 1990; Tobacyk, 1983). Most reports of education-induced paranormal belief change may thus have derived simply from passing time (or other external influences) or from students' reaction to their identifiability. These are significant and rather obvious interpretive obstacles. However, even studies comparing paranormal-skepticism courses with controls, with anonymous belief reporting, likely suffered from an additional problem, *demand characteristics* (Orne, 1962): Students may simply have provided the instructor-as-investigator with the obviously desired responses (i.e., that they are now more skeptical of the paranormal than they were before). Of course, such demand characteristics may contaminate the assessment of *any* experimental, educational, or clinical interventions designed to change subjective outcomes (see, e.g., Laney et al., 2008). But is there a compelling way around them?

Debiasing via Hindsight Bias

The present study harnessed a much-studied cognitive bias—*hindsight*—as a novel means to circumvent demand characteristics in self-reported psychological change. Laboratory investigations of hindsight bias typically ask subjects to predict event outcomes or to answer trivia questions before providing them with the actual outcomes or answers (Fischhoff, 1975; for a review, see Hawkins & Hastie, 1990). Hindsight bias occurs when outcome knowledge colors subjects' subsequent reports (and, ostensibly, beliefs) about their initial state of knowledge, such that they “knew it all along” (Hasher, Attig, & Alba, 1981). Most relevant to the present study, hindsight has also been demonstrated beyond the cognitive psychology laboratory, with people's current attitudes and beliefs biasing their recollections of their own personal past, in a form of false memory (Ross, 1989). For example, when adults recall their adolescent political attitudes and beliefs, previous emotions, or substance use, their recollections are strongly influenced (and sometimes, *most* strongly influenced) by their current attitudes, beliefs, emotions, and behaviors, rather than by their actual past attitudes and behaviors (see, e.g., Collins, Graham, Hansen, & Johnson, 1985; Field, Thompson, & Gallagher-Thompson, 2006; G. B. Markus, 1986). This holds even following a challenge to one's beliefs, such as writing a counter-attitudinal essay: Students who chose to write an essay arguing against their belief that students should have considerable control over the courses taught at their university subsequently misremembered that they had previously held that belief much less strongly than they actually did (Bem & McConnell, 1970). It seems, then, that adults generally hold implicit theories of belief and trait stability, even in the face of potentially change-inducing events, and so when they recall their past actions and opinions they are unduly influenced by their psychological present (Ross, 1989). Thus, if I am skeptical of the paranormal now, for example, then I am likely to remember myself—rightly or wrongly—as having been similarly skeptical in the past.

To exploit such hindsight systematically, we anonymously probed university students' paranormal beliefs preceding and following a semester-long skepticism course, versus control courses, in two ways. Half of each class reported their current beliefs at both times (the typical, demand-vulnerable procedure); the other half reported their current beliefs at Time 1 but tried to reproduce exactly their Time 1 responses at Time 2 from memory (the hindsight procedure). Given actual belief change (toward nonbelief), skepticism students should have reported their Time 2 paranormal beliefs to have been weaker than those at Time 1, and weaker than those of Time 2 controls. Moreover—and critically—with the hindsight procedure, they (but not controls) should have recalled themselves as having been more skeptical at Time 1 than they actually were.

METHOD

We compared pre- with postcourse paranormal beliefs in both skepticism courses (precourse $N = 340$) and control courses (precourse $N = 238$). The semester-long skepticism course (PSY 318, *Belief in “Weird” Things*) was taught over three different semesters by the first author at the University of North Carolina at Greensboro

(UNCG), a comprehensive state university in the southeastern U.S. with an introductory psychology prerequisite (syllabi available at www.uncg.edu/~mjkane/memlab.html). Through lectures, readings, videos, and demonstrations (from classic memory experiments to mentalist magic tricks), the course focused on the philosophy and methods of science, the idea and perils of naive realism, various cognitive biases and illusions that may create and sustain false beliefs, and the empirical evidence (pro and con) regarding many paranormal and pseudoscientific phenomena. The instructor repeatedly made it clear that students would not be graded on the basis of their beliefs and that, beyond two anonymous surveys, they would never be asked to reveal their beliefs in the course context.

Control classes were three semester-long UNCG psychology courses with identical prerequisites, each taught by a different instructor (including one by the third author); they were survey courses in developmental psychology; cognitive psychology; and sex, gender, and behavior. Skepticism and control classes had equivalent subject-retention rates (56% and 57%, respectively) between Time 1 (precourse) and Time 2 (postcourse). Lost data reflected course withdrawals, isolated absences from class when questionnaires were administered, or students' failure to use the same identity-protecting PIN code on both pre- and postcourse questionnaires.

We collected belief-report measures from skepticism courses at the very beginning of the first and last classes, and from control courses some time during the first and last 1.5 weeks of the semester. At Time 1, all students responded according to their current beliefs. At Time 2, we color-coded belief measures and distributed them pseudorandomly from a shuffled pile (by seating); students who received questionnaires in one color reported their current beliefs (the typical procedure), and students who received them in the other color did so by recollecting their Time 1 belief reports (the hindsight procedure). To emphasize to hindsight-questionnaire students that we wanted them to accurately recall their prior beliefs in an unbiased way (i.e., to create an "experimental demand" for memory accuracy; Bem & McConnell, 1970; Fischhoff, 1977), we wrote the following instructions on the questionnaires and reinforced them orally: "Please read each statement and try to recall how strongly you either believed or disbelieved in it the last time you completed this questionnaire, by circling a number from 1–7. We do *not* want you to respond according to your current beliefs, but rather according to your beliefs before you took this course . . ." (all emphases in the original). Students created PIN codes for their Time 1 and Time 2 measures to allow anonymous linking of individual students' pre- and postcourse responses. We collected no demographic information, in order to satisfy IRB concerns about student anonymity given that the subjects were also the investigators' students.

The belief-report measure presented 52 items representing seven categories: psychics/ESP, alternative medicine/healing, superstitions/omens, UFOs/alien abduction, astrology, creationism, and Judeo-Christian/biblical (for the complete measure, see www.uncg.edu/~mjkane/memlab.html). Judeo-Christian/biblical beliefs, aside from creationism, were not addressed in the course materials but acted as a control category. For all items, students rated their belief on 7-point scales anchored by 1 (*strongly disbelieve*), 4 (*unsure*), and 7 (*strongly believe*). Principal components analysis (oblimin rotation) on all Time 1 data ($N = 578$) yielded seven components with eigenvalues greater than 1. To simplify the data and to best represent the skepticism-course topics, we selected the five or six highest loading items from each component, after splitting one component into separate Judeo-Christian/biblical and creationism categories (because only the latter reflected course material) and combining a single-item meditation component with the related alternative medicine/healing component (see Table 1); we then averaged the five to six item scores for each belief category and for each student (after reverse scoring any items with negative component loadings), and analyzed those mean category scores.²

RESULTS AND DISCUSSION

We analyzed belief-change data only from the students who completed both Time 1 and Time 2 measures ($N = 190$ and $N = 136$ in skepticism and control courses, respectively). Critically, the belief categories we derived from the questionnaire were reliably measured: Spearman–Brown test–retest reliabilities for each belief

category, which were based on control students who completed current-belief measures at both time points (and who thus received no intervention or hindsight manipulation; $N = 72$), ranged from .89 to .97.

A significant four-way interaction among course (skepticism vs. control), time (pre vs. post), postcourse questionnaire procedure (current beliefs vs. hindsight), and belief category [$F(6,1932) = 3.83$, $MS_e = 0.32$, $p = .001$, $\eta_p^2 = .01$], led us to examine each assessment procedure and category separately. In reporting their current beliefs (see Figure 1A), students in the skepticism course showed significantly greater pre-to-post decreases than did controls in only some of the categories; indeed, the course \times time \times belief category interaction was significant [$F(6,1014) = 12.15$, $MS_e = 0.33$, $p < .001$, $\eta_p^2 = .07$]. Except for Judeo-Christian/biblical and creationism beliefs, all belief categories showed greater decreases for skepticism-course students than for controls [for these course \times time interactions, $F_s(1,169)$ ranged from 12.12 to 72.62, $p_s \leq .001$, and η_p^2 s ranged from .07 to .30]. Noncreationist Judeo-Christian/biblical beliefs were not addressed in the course materials, and creationist beliefs were expected to be difficult to change, particularly in the “Bible Belt” of the southeastern U.S.

Table 1
Principal Components Loadings (Oblimin Rotation) for Items Selected for Pre- to Postbelief Change Analyses

Item (Paraphrase)	Psychic	AltMed	Aliens	Astrology	Omens	Bible/Creation
Some people can foresee events	.756	–	–	–	–	–
ESP is real	.690	–	–	–	–	–
Psychically sense family in trouble	.639	–	–	–	–	–
Some dreams predict future events	.626	–	–	–	–	–
Some can communicate with dead	.578	–	–	–	–	–
Herbal remedies preferred over meds	–	.769	–	–	–	–
Alternative meds more effective	–	.758	–	–	–	–
Modern medicine should learn from ancients	–	.670	–	–	–	–
Med based on spirituality over science	–	.369	–	–	–	–
Meditate important for healthy soul, spirit	–	.244	–	–	–	–
Many UFOs actually alien spacecraft	–	–	.858	–	–	–
Some abducted by beings from other planets	–	–	.842	–	–	–
Beings from other planets often visit Earth	–	–	.837	–	–	–
U.S. government hides alien evidence	–	–	.804	–	–	–
Roswell flying saucer crash concealed	–	–	.774	–	–	–
Intelligent life exists on other planets	–	–	.582	–	–	–
Someday I will consult an astrologer	–	–	–	.709	–	–
Astrologers useful consultants on decisions	–	–	–	.676	–	–
Planets/stars affect personality and life events	–	–	–	.670	–	–
Astrology can predict aspects of future	–	–	–	.642	–	–
Nostradamus accurately predicted events	–	–	–	.446	–	–
Breaking a mirror can bring bad luck	–	–	–	–	.823	–
Walking under ladders brings bad luck	–	–	–	–	.799	–
The number 13 is truly unlucky	–	–	–	–	.790	–
Athletes on <i>Sports Illustrated</i> cover jinxed	–	–	–	–	.645	–
Bad things happen on Friday 13th	–	–	–	–	.628	–
Good luck charms help school performance	–	–	–	–	.602	–
The Biblical Heaven exists	–	–	–	–	–	.896
The Biblical God exists	–	–	–	–	–	.896
The Biblical Hell exists	–	–	–	–	–	.894
Biblical Satan exists	–	–	–	–	–	.875
I am a very religious person	–	–	–	–	–	.873
Humans evolved with no help from God	–	–	–	–	–	–.867
Teach Biblical creation in bio class	–	–	–	–	–	.780
God created plants/animals as seen today	–	–	–	–	–	.679
The Earth is only 6,000–10,000 years old	–	–	–	–	–	.647
Evolution only a theory; can't be proven	–	–	–	–	–	.623

Note—Psychic, psychics/ESP; AltMed, alternative medicine/healing; Aliens, UFOs/alien abduction; Omens, superstitions/omens; Bible/Creation, Judeo-Christian/biblical and creationism.

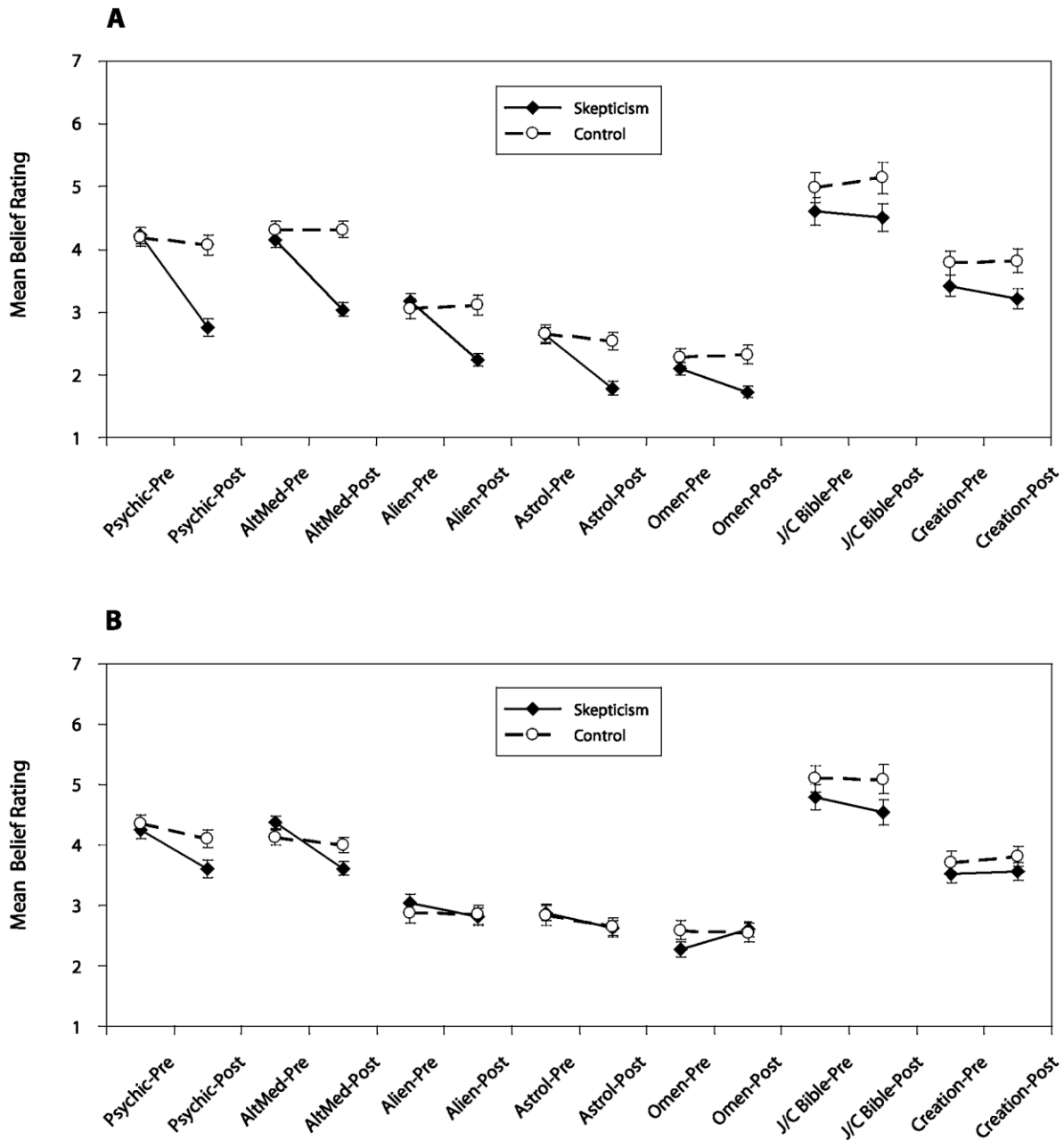


Figure 1. Mean pre- and postcourse belief ratings (on a 7-point scale), for students in skepticism and control courses, across seven topics: psychics/ESP (Psychic); alternative medicine/healing (AltMed); UFOs/alien abduction (Alien); astrology (Astrol); superstitions (Omen); Judeo-Christian/biblical (J/C Bible); and creationism (Creation). (A) Students reporting on their current beliefs at both Time 1 and Time 2. (B) Students reporting current beliefs at Time 1 and attempting to reproduce their Time 1 responses at Time 2. Error bars represent standard errors.

It was clear, however, that for phenomena related to psychics/ESP, alternative medicine/healing, UFOs/alien abductions, astrology, and superstitions/omens, students in the skepticism course reported themselves to be much more skeptical of the paranormal and of pseudoscience following the course than they were before and reported themselves to be more skeptical than did students in the control courses. Moreover, these significant effects came in the context of skepticism- and control-course students reporting statistically identical beliefs on the precourse measures: The overall main effect of course at Time 1 was nonsignificant [$F(1,169) = 1.22, MS_e = 4.48, p > .27$], and for each of the five belief categories showing a course \times time interaction above, all main effects of course at Time 1 yielded nonsignificant differences [$F_s(1,169) < 1.16, p_s > .28$]. Skepticism- and control-course outcome differences, therefore, were not driven by selection biases.

For students completing the hindsight measure (Figure 1B)—that is, those who attempted to recall their Time 1 responses at Time 2—the course \times time \times belief category interaction was, again, significant [$F(6,918) = 5.84$, $MS_e = 0.31$, $p < .001$, $\eta_p^2 = .04$]. Of most importance, for psychics/ESP and alternative medicine/healing beliefs—the topics covered most intensely by the skepticism course (see below)—skepticism-course students were more likely than controls to remember themselves as more skeptical before the course than they had been [course \times time interactions: psychics/ESP, $F(1,153) = 6.20$, $p < .05$, $\eta_p^2 = .04$; alternative medicine/healing, $F(1,153) = 23.83$, $p < .001$, $\eta_p^2 = .14$]. Whereas skepticism- and control-course students reported statistically equivalent psychics/ESP and alternative medicine/healing beliefs before the courses began [psychics/ESP, $F(1,153) < 1$; alternative medicine/healing, $F(1,153) = 2.34$, $MS_e = 0.94$, $p = .13$], skepticism-course students, postcourse, recalled themselves as having been more skeptical than did control students [psychics/ESP, $F(1,153) = 4.81$, $MS_e = 1.85$, $p < .05$, $\eta_p^2 = .03$; alternative medicine/healing, $F(1,153) = 5.69$, $MS_e = 0.99$, $p < .05$, $\eta_p^2 = .04$]. Note that these patterns reflected more than just regression to the mean: Skepticism-course students' Time 2 recollections for both psychics/ESP and alternative medicine/healing were further from the scale midpoint, and further from the Time 1 and Time 2 control-group recollections, than were their Time 1 belief reports.

Above, we claim that psychics/ESP and alternative medicine/healing beliefs changed more than did those of other paranormal topics because of a systematic treatment effect (i.e., a dose–response relation). Whereas approximately eight skepticism-class periods (roughly 10 h) were dedicated to psychics/ESP and alternative medicine/healing topics combined, only four and a half class periods (5.6 h) were devoted to superstitions/omens, UFOs/ alien abduction, and astrology topics combined. To the extent that video materials and live demonstrations increase the vividness, memorability, and long-term impact of messages (see, e.g., Reyes, Thompson, & Bower, 1980; Ruscio, 2000), moreover, we offer that, across different semesters, psychics/ESP and alternative medicine/healing topics were supplemented by 18–23 videos (ranging from 4 to 60 min each) and five demonstrations (from 5 to 60 min each), whereas superstitions/omens, UFOs/ alien abduction, and astrology topics were supplemented by only 2–3 videos (ranging from 3 to 60 min each) and only two demonstrations (from 5 to 10 min each). The two paranormal topic areas that demonstrated significant hindsight-bias effects (and the largest effects on the current-belief questionnaire) thus accounted for almost twice as much class time, and almost five times as many video or demonstration activities, as did the three paranormal topics that showed no hindsight bias; there may be an analogy here to laboratory studies that have found hindsight biases to increase with greater frequency of the “outcome” information (e.g., Wood, 1978).

The evidence strongly suggests that the skepticism course effected real and substantial belief change. Not only did skepticism-course students report themselves to be currently less credulous regarding paranormal claims following the course, but they also recalled themselves as having been more skeptical before the course than they had actually been, at least in two primary topic domains. We might have reason to be skeptical, ourselves, of the current-belief reports, since they may partially reflect demand characteristics.³ The hindsight-bias procedure, however, tapped into subjects' beliefs in a way that circumvented demand. Not only has basic laboratory research on hindsight indicated minimal social-desirability or motivational influence (Hawkins & Hastie, 1990), but it is unlikely here that any particular social demand would have led students to feign or exaggerate their prior skepticism in only two paranormal domains on the hindsight questionnaires while endorsing skepticism in all five (nonbiblical) paranormal domains on the current-belief questionnaire.

In fact, previous research suggests that demand characteristics in our hindsight procedure would have yielded the *opposite* results (see Ross, 1989). In intervention contexts that lead subjects to expect change (study-skills courses, pain-treatment programs), but in which little objective change actually occurs, people retrospectively adjust their personal recollections “downward” in order to appear more changed (e.g., they recall their initial study skills or initial pain levels as having been worse than they actually were; Conway & Ross, 1984; Linton & Melin, 1982). Most relevant to present concerns, such downward adjustments can appear in people's recollections of past attitudes as well: Subordinates whose supervisors completed a management-training course showed no objective pre-to-post change in their attitudes about work (commitment to the team, sense of

direction), but after their boss's course they remembered themselves as having originally had worse attitudes than they reported at the time (Taylor, Russ-Eft, & Taylor, 2009). In the context of the present study, then, any such demand-induced biases should have led our skepticism-course students to support their (unfounded) expectation of a change toward skepticism by recalling themselves as having been more credulous than they had actually been, rather than more skeptical than they had been.

CONCLUSION

Our study exploited the hindsight bias to show that, for several deeply covered topics, educational interventions reduced paranormal beliefs beyond the effects of demand characteristics. Of broader significance, the findings indicate that any intervention program that creates and measures psychological change may circumvent demand effects by harnessing hindsight: People who truly change may misremember themselves as having been just as they are now. Indeed, regarding the pseudoscientific claims of psychics and alternative healers, our skepticism-course students believed that they had "pooh-poohed it all along."

AUTHOR NOTE

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NOTES

1. Only some of the samples from Dougherty (2004) and Gray (1985) were compared with controls; Wesp and Montgomery (1998) compared skepticism-course students with controls in thinking skills, but they did not evaluate students' beliefs.
2. Because the alternative medicine/healing composite measure included two items with fairly low factor loadings (see Table 1), we reran the relevant ANOVAs using a second composite that included only the three high-loading items. This three-item composite yielded slightly lower mean endorsement ratings than those we report for the full, five-item composite, but the statistical patterns (all main effects and interactions) were unchanged.
3. Of course, with the current-belief procedure there is simply no way to determine exactly how much influence demand characteristics might be having on subjects' responses (this is what motivated our use of the hindsight procedure, after all). At the same time, we do not believe that students' reports of their current beliefs were driven entirely by demand characteristics, because they reported belief change selectively. Note that skepticism students did not report being less believing of creationism claims at the end of the course, despite the devotion of significant lecture and reading material to discussing creationism as a pseudoscientific system. If demand had been overwhelmingly responsible for students' belief reports, they would have indicated significant belief change in creationism.