


# Fluid Movement and Fluid Social Cognition: Bodily Movement Influences Essentialist Thought

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## Abstract

Rigid social categorization can lead to negative social consequences such as stereotyping and prejudice. The authors hypothesized that bodily experiences of fluidity would promote fluidity in social-categorical thinking. Across a series of experiments, fluid movements compared with nonfluid movements led to more fluid lay theories of social categories, more fluidity in social categorization, and consequences of fluid social-categorical thinking, decreased stereotype endorsement, and increased concern for social inequalities. The role of sensorimotor states in fluid social cognition, with consequences for social judgment and behavior, is discussed.

## Keywords

social cognition, essentialism, processing style, embodied cognition

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From business entrepreneurs to yoga instructors, many endorse the idea that flexible thinking is linked to bodily processes and suggest that when searching for a new idea, a creative solution, or insight, the key to finding that new perspective can be found in a simple exercise, bodily movement. Innovation and creativity consulting, for example, is a large industry, which endorses the idea that constraints from creativity can be lifted by freedom of movement. For instance, one of the most highly regarded consulting firms charges US\$200,000 for a 1-day session to train a company's employees to think more creatively (Segal, 2010). The first step of this training is for trainees to perform yoga-like stretching exercises before the brainstorming begins (Segal, 2010), and this aligns with the belief that the fluid and free movements of yoga promote fluid and flexible thinking and an open mind (Stapleton, 2004). Beyond creativity, flexible thinking and an open mind may even be essential for solving social problems, especially those related to prejudice and stereotyping. Indeed, the belief that race is a fluid, malleable construct increases concern for racial inequality (Williams & Eberhardt, 2008). Rigid views of race, in contrast, lead individuals to believe that racial categories have fixed and discrete category boundaries (Chen & Hamilton, 2012), with negative consequences including stereotyping and justification for racial inequalities (Bastian & Haslam, 2006; Williams & Eberhardt, 2008). Fluid thinking about racial categories might therefore lead to perceptions of fluid boundaries between races, which could bring reductions in

stereotyping and prejudice. As prior work demonstrates that fluid movement influences creativity (an outcome of fluid cognitive processing; Slepian & Ambady, 2012), perhaps fluid movement will also influence the processing of social categories. The present work seeks to explore whether movement might influence thinking about social categories, integrating the distinct literatures on sensorimotor processes, cognitive processing style, and essentialism. Specifically, we argue that fluid movements should influence social categorization, lay theories about social categories, and their downstream consequences.

The hypothesis that movement patterns in one domain (e.g., fluid movement) can influence patterns of cognition in another domain (e.g., fluid thinking about race) is consistent with research on cognitive processing style. Once activated, a cognitive processing style elicited in one domain can influence how people respond in an unrelated, *distinct* domain. For instance, participants prompted to think about socially

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deviant groups (e.g., “punks”) exhibited a deviant, divergent processing style (i.e., divergent thinking) in unrelated creativity tasks (Förster, Friedman, Butterbach, & Sassenberg, 2005). Similarly, on the assumption that creative thinking requires people to avoid conventional thinking, Sassenberg and Moskowitz (2005) hypothesized and found that a creativity induction reduced automatic stereotype activation. Thus, “thinking differently” in one domain led individuals to “think differently” about social targets in another domain, diminishing stereotype activation. These studies demonstrate that cognitive processing styles activated in one domain can have consequences in other distinct domains.

From this work, it therefore appears that generalized modes of information processing can be temporarily activated, and that such activation applies to a range of judgments and behaviors. Hence, *cross-domain processing activation* occurs when a processing style elicited in one domain (e.g., creativity) influences judgments in a distinct and separate domain (e.g., stereotype activation). The current work seeks to make two significant advances to this prior work. First, we test whether a specific mode of social-cognitive processing, essentialism, can be influenced by a more general cognitive processing style—fluid processing (i.e., fluent and flexible processing). Thus, this work examines whether a general processing style can have an influence in a more specific yet also consequential domain of social judgment and categorization. A general fluid processing style, characterized by fluent and flexible thinking, might lead to fluid social cognition, reflected in reduced essentialist thinking about social categories. The current work examines the effects of processing style on essentialist thinking about social categories, examining influences on lay theories of social categories and the social-categorization process, as well as known outcomes of essentialism, including stereotype endorsement and concern for social inequalities.

Second, the current work aims to significantly broaden the demonstration of cross-domain processing activation. Prior work has demonstrated that a cognitive processing style activated in one domain can influence cognition in another domain. The transfer of cognitive processing style from one domain to another is clearly relevant to everyday cognition, as people move from one task to another quite frequently. Such work focuses on demonstrating that these generalized modes of information processing can be activated by cognitively elaborating (i.e., reading or writing) on propositional information. Recent research suggests that cognitive processing is not always rooted in symbolic or propositional representations but can also be rooted in sensory-based “perceptual representations” (Ackerman, Nocera, & Bargh, 2010; Lee & Schwarz, 2010; Slepian, Rule, & Ambady, 2012; Topolinski & Sparenberg, 2012; Zhong & Liljenquist, 2006; for a review see Meier, Schnall, Schwarz, & Bargh, 2012). The current work explores how generalized modes of information processing might be influenced by sensorimotor activation, and thus examines *cross-modal* processing style activation. We

examine whether physical movement can promote a processing style that has diverse influences on social cognition.

## Fluid Processing and Essentialist Thought

To enable efficient social cognition, people tend to adopt an essentialist, rigid processing style characterized by perceiving rigid boundaries between social categories (Brewer, 1988; Fiske & Neuberg, 1990; Macrae & Bodenhausen, 2000). Yet, instead of reflecting mutually exclusive differences that exist in the world, social categories generated by human minds artificially draw meaningful distinctions when there may be none (Rothbart & Taylor, 1992). Race, for instance, provides a prototypical example of such essentialist thought about social categories. Although there is little evidence that distinct racial categories exist in human biology (see Graves, 2001; Lewontin, 1972; Marks, 1995), many people treat racial categories as if they represent distinct groups, having fixed and discrete boundaries (Rothbart & Taylor, 1992).

Thinking about social categories as fixed, discrete, and immutable leads to negative outcomes including stereotyping (Bastian & Haslam, 2006; Levy, Stroessner, & Dweck, 1998; Plaks, Stroessner, Dweck, & Sherman, 2001; Yzerbyt, Corneille, & Estrada, 2001), dehumanization of the outgroup (Leyens et al., 2000), and justification for social inequalities (Keller, 2005; Verkuyten, 2003; Williams & Eberhardt, 2008). Yet, not everyone ascribes to the view that social categories are rigid and mutually exclusive. For instance, after reading an ostensible scientific article that racial categories are not based in, individuals are more likely to believe that race is a socially constructed and fluid construct without a biological basis (Williams & Eberhardt, 2008).

Essentialist thought about social categories seems to be associated with a style of social-information processing that relies on rigid, fixed, and discrete representations of social categories. Prior work manipulating essentialist thought has relied on cognitive elaboration of specific content. That is, essentialism can be enhanced by making fixed and immutable properties of social categories salient (e.g., reading and thinking about their biological basis) but can also be diminished by making their malleable and fluid properties salient (e.g., reading that they are socially constructed). We suggest, however, that more general cognitive processing styles may promote or interfere with essentialist thinking in social cognition. Specifically, a fluid cognitive processing style might interrupt essentialist thinking about social categories.

## Fluid Movements and Fluid Social Cognition

In the current work, we propose that modes of social-cognitive processing can be activated by physical movement. We examine whether fluid sensorimotor movement may lead to

more fluid social-cognitive processing, thereby interrupting essentialist thinking and reducing its impact on social cognition. This possibility is informed by a recent series of studies, whereby fluid arm movement led to a fluid processing style (fluent, free-flowing, and flexible thinking) resulting in greater creativity across a variety of tasks (Slepian & Ambady, 2012). Drawing from this work, we suggest that the fluid processing style promoted by the bodily experience of fluidity should also reduce essentialist thinking about social categories (i.e., the view that social categories are rigid, discrete, and fixed). We test this idea across several studies by examining the influence of fluid movement on essentialist views toward social categories in general, and race in particular. In so doing, we examine a variety of outcomes including lay theories of social categories, social categorization, stereotype endorsement, and concern for social inequalities.

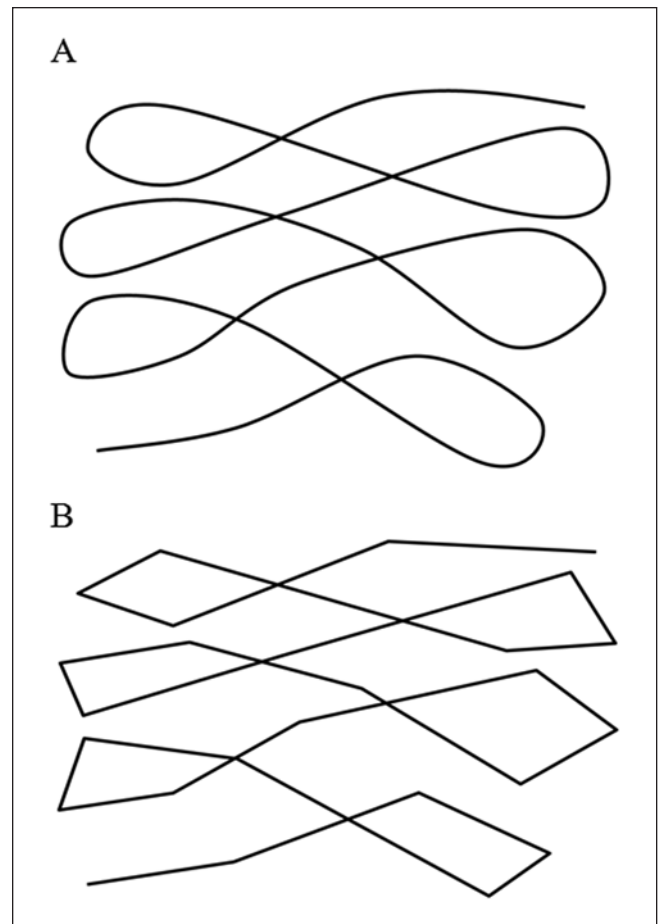
## Study 1

Study 1 examined explicit beliefs about racial category boundaries, testing whether fluid, relative to rigid, movements would lead participants to believe that boundaries between social categories are more fluid.

## Method

Participants were randomly assigned to one of two conditions. In the “fluid condition,” participants traced three drawings that induced fluid movement. In the “nonfluid condition,” participants traced three nonfluid drawings that were precisely the same as the fluid ones, but without line curvature, the element that led to fluid movement (Figure 1). These manipulations, presented via a computer monitor, were pretested by Slepian and Ambady (2012) to be equivalent in tracing difficulty and the level of affect induced by the tracing procedure.

Forty-five undergraduates (73% female; 77% white, 10% Asian, 10% Multiracial, 3% African American)<sup>1</sup> were randomly assigned to trace either the three fluid or the three nonfluid drawings and subsequently completed a mood measure (from Friedman & Förster, 2000) to explore the role of mood in the present context. They first indicated their overall current mood (“How do you feel right now?”) on a scale of 1 (*very bad*) to 9 (*very good*) and then rated specific feelings (calm, concerned, content, disappointed, nervous, down, happy, joyful, nervous, relaxed, and tense) from 1 (*not at all*) to 9 (*extremely*). Finally, participants filled out the Race Conceptions Scale (sample item: “It’s possible to be a full member of more than one race,” reverse scored, from 1 (*strongly disagree*) to 7 (*strongly agree*; Williams & Eberhardt, 2008). Higher scores on this scale ( $\alpha = .82$ ) indicate support for the essentialist belief that racial categories have rigid boundaries based in biology whereas lower scores indicate more fluid processing of racial categories, indicating support for the belief that their boundaries are fluid and socially constructed.



**Figure 1.** Example line drawing stimuli, which participants traced to induce fluid arm movement (A) or nonfluid arm movement (B).

## Results and Discussion

Participants who had made fluid arm movements believed that race had less rigid boundaries ( $M = 3.88$ ,  $SD = 0.70$ ) than did participants who had made nonfluid arm movements ( $M = 4.28$ ,  $SD = 0.63$ ),  $t(43) = 2.03$ ,  $p = .048$ ,  $r = .30$ . There were no differences in overall mood, ( $M_{fluid} = 5.62$ ,  $SD = 1.72$ ;  $M_{nonfluid} = 6.04$ ,  $SD = 1.33$ ),  $t(43) = 0.93$ ,  $p = .36$ , positive affect ( $M_{fluid} = 5.90$ ,  $SD = 1.44$ ;  $M_{nonfluid} = 6.21$ ,  $SD = 1.33$ ),  $t(43) = 0.74$ ,  $p = .47$ , or negative affect ( $M_{fluid} = 3.30$ ,  $SD = 1.45$ ;  $M_{nonfluid} = 2.92$ ,  $SD = 1.16$ ),  $t(43) = 1.00$ ,  $p = .33$ . Fluid bodily movement, independent of mood, and relative to nonfluid yet otherwise similar movements, led to perceivers to believe that boundaries between races were more fluid and less rigid.

## Study 2

In Study 1, fluid movement influenced essentialist beliefs about social categories. In Study 2, we examined whether fluid movement would also influence essentialist thinking in a social-categorization task. Consistent with a reduction in essentialism, a fluid processing style should lead participants

to eschew a rigid social-categorization scheme. For instance, people often assign a discrete racial category to a target individual who actually belongs to several such categories (i.e., multiracial; see Ho, Sidanius, Levin, & Banaji, 2011; Peery & Bodenhausen, 2008). Such findings suggest that racial categorization can often be characterized as reflecting the essentialist assumption of rigid category boundaries. Indeed, prior studies demonstrate that beliefs about racial essentialism are reflected in the tendency to categorize racially ambiguous targets as belonging to only a single category (Chen & Hamilton, 2012). Here, we examined whether a domain-general manipulation of processing style could have consequences for social categorization. We predicted that fluid, relative to nonfluid, movement would lead participants to exhibit less rigidity in their social categorizations and to more often categorize racially ambiguous targets as biracial.

### Method

Forty undergraduates (80% female; 67.5% White, 20% Asian, 7.5% Multiracial, 2.5% African American, 2.5% Latino) were randomly assigned to trace either the three fluid or the three nonfluid drawings. They then completed the mood measure from Study 1. Subsequently, participants were presented with 20 Black/White racially ambiguous faces (10 male, 10 female). These faces, created by morphing photographs of Black and White individuals, were extensively tested in previous work (Pauker, Ambady, & Freeman, in press), equating them for levels of distinctiveness and attractiveness compared with prototypical Black and White targets and ensuring that the morphed images were truly racially ambiguous to participants' eyes. Faces were presented in a random order, and participants were given the options "Black," "White," and "Biracial" to categorize each face.

### Results and Discussion

Participants again did not differ in overall mood ( $M_{fluid} = 6.40$ ,  $SD = 1.05$ ;  $M_{nonfluid} = 6.10$ ,  $SD = 1.37$ ),  $t(38) = 0.78$ ,  $p = .44$ , positive affect ( $M_{fluid} = 6.44$ ,  $SD = 1.09$ ;  $M_{nonfluid} = 6.10$ ,  $SD = 1.21$ ),  $t(38) = 0.93$ ,  $p = .36$ , or negative affect ( $M_{fluid} = 2.56$ ,  $SD = 1.03$ ;  $M_{nonfluid} = 2.78$ ,  $SD = 1.04$ ),  $t(38) = 0.68$ ,  $p = .50$ . Number of categorizations was compared across conditions. Critically, and as predicted, participants who made fluid arm movements categorized faces more often as biracial ( $M = 9.80$ ,  $SD = 3.43$ ) than those who made nonfluid movements ( $M = 7.80$ ,  $SD = 2.95$ ),  $t(38) = 2.43$ ,  $p = .02$ ,  $r = .37$ .<sup>2</sup>

Fluid, relative to nonfluid, physical movement promoted a more fluid social-cognitive processing style in which perceivers categorized racially ambiguous faces as Black *and* White (i.e., biracial) rather than Black *or* White.

### Studies 3a and 3b

Study 1 demonstrated that fluid movement influenced participants' self-reported beliefs about the fluidity of social

categories. A fluid social-cognitive processing style should be associated not only with beliefs about social categories but also with how those categories are processed. Indeed, Study 2 demonstrated that fluid movement led to more fluid social categorization of faces. The studies thus far, however, have lacked a control condition, only including fluid and rigid movement conditions. In Study 3, we added a control condition, allowing us to examine which movement, if not both, was influencing fluid social-cognitive processing.

Study 3 also used another manipulation of fluid movement. Prior work suggests that there is a functional equivalence of perception and action, wherein both share a common representational code (Hommel, Müsseler, Aschersleben, & Prinz, 2001). A converging body of evidence suggests that the perception of motion relies on the same representation as enacting motions and can evoke the same sensory consequences (Blakemore & Decety, 2001; Rizzolatti, Craighero, & Fadiga, 2002). Consistent with this work, we predicted that visual perception of fluid movement would have a similar influence as fluid arm movement.

In the fluid and nonfluid condition, participants watched a red circle, starting from the upper-right, and over the course of 22 seconds, trace the line drawing in Figure 1A (fluid) or 1B (nonfluid). In the control condition, the red circle started from the same location as in the other two conditions (with no line drawing behind it), faded away, and then reappeared in another location 8 times more during the 22 s. This latter condition therefore included no continuous movement, but each location the red circle appeared in matched corresponding locations from the red circle's movement in the other two conditions.

### Method

In Study 3a, 60 participants ( $M_{age} = 30$  years; 50% female; 82% White, 12% Asian, 3% African American, 3% Multiracial or Other) recruited online from Mechanical Turk (see Buhrmester, Kwang, & Gosling, 2011), watched a video displaying fluid, nonfluid, or no continuous movement (based on random assignment) and subsequently completed the racial categorization task from Study 2. Finally, an attention check asked participants to describe the video. In Study 3b, 99 participants recruited from Mechanical Turk ( $M_{age} = 33$  years; 55% female; 79% White, 10% Asian, 6% African American, 2% Latino, 3% Multiracial or unreported) participated in the same procedure as Study 3a, but with a different set of stimuli, morphed images of Black and White computer-generated faces (from Pauker et al., 2009), rather than morphed photographs of Black and White faces as in Study 2 and 3a.

### Results and Discussion

Eight participants in Study 3a and 15 participants in Study 3b failed the attention check, and these participants were



therefore excluded.<sup>3</sup> Study 3a did not replicate Study 2 (with the new manipulation), with no significant effect of movement observation on biracial categorization ( $M_{fluid} = 7.53$ ,  $M_{nonfluid} = 7.78$ ,  $M_{control} = 7.64$ ),  $F(2, 49) = -0.29$ ,  $p = .97$ ,  $\eta^2 = -.001$ . In Study 3b, however, there was significant variation across conditions in Biracial categorizations ( $M_{fluid} = 7.96$ ,  $M_{nonfluid} = 5.50$ ,  $M_{control} = 6.81$ ),  $F(2, 81) = 3.03$ ,  $p = .05$ ,  $\eta^2 = .07$ , and planned follow-up contrasts demonstrated that participants who observed fluid movement categorized more faces as Biracial than did those who observed nonfluid movement,  $t(81) = 2.46$ ,  $p = .02$ ,  $r = .26$ .<sup>4</sup> The control condition fell between the other two conditions and did not differ significantly from either,  $ps > .20$ ,  $rs < .15$ , and thus perhaps both fluid and nonfluid movement promote fluid and nonfluid processing, respectively. Replicating Study 2, but with a different manipulation of fluid movement, observing fluid movement led participants to categorize racially ambiguous faces more often as Biracial (Study 3b; to assess the nonsignificant effect from Study 3a, we later conduct a meta-analysis of the studies).

## Study 4

In Studies 1 through 3, fluid movement led to a fluid social-cognitive processing style, as evidenced by beliefs about the fluidity of social categories and fluid social categorization. The next two studies sought to examine downstream consequences of essentialism in social-categorical processes.

One particularly negative outcome of essentialism when applied to social categories is increased stereotype endorsement (Bastian & Haslam, 2006). Extending the prior studies, Study 4 examined whether fluid movement could diminish stereotype endorsement for a number of social categories (not just racial categories).

## Method

Sixty participants ( $M_{age} = 29$  years; 63% female; 65% White, 17% Asian, 7% Latino, 5% African American, 2% Native American, 4% Multiracial or unreported), recruited online from Mechanical Turk, viewed videos of fluid or rigid movement (from Study 3) and then completed a measure of stereotype endorsement (adapted from Bastian & Haslam, 2006). Participants were presented with five social groups (males, females, doctors, lawyers, and politicians) and 12 stereotypes per group, half positive, half negative (e.g., eloquent, and deceptive, for lawyers, from Bastian & Haslam, 2006). They rated each stereotype on a 5-point scale from 0 (*not at all true*) to 4 (*extremely true*). Finally, an attention check asked participants to describe the video.

## Results and Discussion

The attention check identified one participant who did not actually watch the video, and this participant was therefore excluded. Ratings of stereotype endorsement were averaged

across all groups to create a global stereotype endorsement score. As predicted, participants who observed fluid movement endorsed stereotypes *less* ( $M = 3.10$ ,  $SD = 0.70$ ) than did those who observed nonfluid movement ( $M = 3.46$ ,  $SD = 0.49$ ),  $t(57) = 2.32$ ,  $p = .02$ ,  $r = .29$ . Previous work demonstrates that reductions in essentialist thinking reduce stereotype endorsement (Bastian & Haslam, 2006). Here, fluid, relative to nonfluid, movement decreased this tendency to endorse stereotypes.

## Study 5

Study 4 demonstrated that the influence of fluid movement extends to one downstream consequence of essentialism: stereotype endorsement. In Study 5, we examined whether the influence of fluid movement extends even further, to feelings about the treatment of outgroup members. Fluid thinking about race heightens concerns for racial inequality (Keller, 2005; Verkuyten, 2003; Williams & Eberhardt, 2008), and thus Study 5 examined whether fluid movement might also give rise to concern when considering racial inequality.

## Method

Forty-eight undergraduates (50% female; 78% White, 8% Asian, 6% Hispanic, 2% Black, 2% Middle Eastern, 4% Multiracial) participated in a procedure that was identical to Study 1, with the exception of a change in the dependent measure (adapted from Williams & Eberhardt, 2008).

After tracing either the fluid or nonfluid drawings, participants read a page-long story created for the current work about racial inequalities. Subsequently, they answered comprehension questions about the story and then filled out a measure assessing their concern about such inequalities: They rated from 1 (*not at all*) to 5 (*extremely*) how moved, concerned, upset, nervous, comfortable, indifferent, relaxed, and apathetic they felt after reading the story with the latter four being reverse scored, and an average of these scores was taken to measure concern ( $\alpha = .71$ ). Also included were three filler items in which participants rated how educated, informed, and knowledgeable they felt after reading the story. Based on previous work that found that fluid thinking about race led to more concern for racial inequalities (Williams & Eberhardt, 2008), we predicted that fluid body movements induced by fluid arm movement, compared with nonfluid arm movement, would also lead to a heightened concern for racial inequalities after reading about them.

## Results and Discussion

Participants who made fluid arm movements expressed more concern for racial inequalities ( $M = 3.01$ ,  $SD = 0.56$ ) than those who made nonfluid arm movements ( $M = 2.59$ ,  $SD = 0.64$ ),  $t(46) = 2.40$ ,  $p = .02$ ,  $r = .33$ . Fluid thinking about racial categories is associated with increased concern for existing racial inequalities (Williams & Eberhardt, 2008). In

the prior studies, fluid movement reduced essentialist thinking about social categories, as demonstrated by beliefs about and the processing of social categories. Here, we find another influence of fluid bodily movement on outcomes associated with fluid processing of social categories. After reading about racial inequalities, fluid relative to nonfluid, movement led to more concern for such racial inequalities.

## Additional Studies and Meta-Analysis

### Additional Studies

Studies 1 to 5 demonstrated that fluid movement can give rise to fluid social-cognitive processing. Fluid movement influenced essentialist cognitions about social categories, including how people thought about race (as more biologically based and rigid or socially constructed and fluid), how they categorized racially ambiguous faces, whether they endorsed stereotypes of specific social groups, and whether they expressed concern for racial inequality. An additional series of studies explored whether this influence might extend to essentialist lay theories about people in general (e.g., whether the kind of person someone is can change; Bastian & Haslam, 2006). We conducted five studies to examine this possibility, all of which used the same self-report measure. Studies 6 to 9 were conducted online, and participants observed fluid or nonfluid movement. In Study 10, conducted in the laboratory, participants enacted fluid or nonfluid movement.

All participants completed a self-report scale that measures essentialist lay theories about the nature of person attributes, assessing whether people believe person traits have underlying essences (adapted from Bastian & Haslam, 2006). The original scale includes 32 items in which respondents indicate their agreement with items from 1 (*strongly disagree*) to 6 (*strongly agree*), with higher scores indicating a stronger reliance on essentialist lay theories about people in general. Examples of items include “when getting to know a person it is possible to get a picture of the kind of person they are very quickly,” and “a person’s basic character is never easily defined” (reversed).

In Study 6, 44 participants (8 participants were excluded for failing an attention check) completed the full 32-item scale from Bastian and Haslam (2006). For Study 7, 67 participants (3 attention exclusions) followed the same procedure, but the original scale was truncated to 24 items; the 8 items that dealt with implicit person theories (from Levy et al., 1998) were eliminated. Neither study resulted in statistically significant effects; Study 6:  $M_{fluid} = 3.32$ ,  $M_{nonfluid} = 3.33$ ,  $t(34) = 0.05$ ,  $p = .96$ ,  $r = .01$ ; Study 7:  $M_{fluid} = 3.64$ ,  $M_{nonfluid} = 3.45$ ,  $t(62) = -1.46$ ,  $p = .15$ ,  $r = -.18$ .

Because online participants might not have been engaged enough throughout the somewhat long scale used in these studies, the truncated scale used in Study 7 was cut in half—down to 12 items. In Study 8, 50 participants completed this shortened scale after observing the fluid or nonfluid

movement (6 participants were excluded from analysis for failing an attention check, and 1 participant was excluded for not finishing the study), and in Study 9, 40 participants completed the same procedure, but reverse-worded items were edited to be worded in the same direction as the other items (in the essentialist direction, 1 participant was excluded from analysis for failing an attention check). Neither study resulted in a statistically significant influence of observation of fluid movement; Study 8:  $M_{fluid} = 3.80$ ,  $M_{nonfluid} = 3.62$ ,  $t(41) = -0.89$ ,  $p = .38$ ,  $r = -.14$ ; Study 9:  $M_{fluid} = 3.61$ ,  $M_{nonfluid} = 3.67$ ,  $t(37) = 0.27$ ,  $p = .79$ ,  $r = .04$ .

For Study 10, we further shortened the scale to four items regarding the biological basis of person attributes (sample item, “The kind of person someone is can be largely attributed to their genetic inheritance.”). These items were selected because they were the most closely related to the outcomes measured in Studies 1 to 5 (especially Study 1). Forty-five undergraduate participants moved fluidly or nonfluidly (as in Study 1) and subsequently completed the 4-item scale. The resulting effect was not statistically significant,  $t(43) = 1.86$ ,  $p = .07$ , although the effect was in the predicted direction ( $M_{fluid} = 3.33$ ,  $M_{nonfluid} = 3.81$ ). Participants who had made fluid arm movements believed that person attributes had a biological basis *less* than did participants who had made nonfluid arm movements. Although the results of Study 10 approached significance, the null results in Studies 6 to 9 suggest that fluid processing failed to influence essentialist lay theories about person attributes in general.

### Meta-Analysis

In the first series of studies, Studies 1 to 5, a total of 302 participants enacted or observed fluid or nonfluid movement and completed measures of essentialist thinking about *social categories*. In the second series of studies, Studies 6 to 10, a total of 227 participants enacted or observed fluid or nonfluid movement and completed a measure of essentialist thinking about *person attributes*. Following procedures outlined in Rosenthal (1991) for combining and comparing effect sizes, we performed separate meta-analyses of the studies conducted on essentialist thought about social categories and of the studies conducted on essentialist thought about person attributes, in general (see further below for the combined effect size of all studies). A meta-analysis of the studies conducted on the processing of social categories yielded an overall effect size of  $r = .264$  (sample-size weighted  $r = .265$ ), a significance level of  $p < .001$ , and a fail-safe  $N$  of 41 unresponsive studies that would be needed to change the combined significance level to nonsignificant. A meta-analysis of the studies conducted on thought about person attributes, in general, yielded an overall effect size  $r = .001$  (sample-size weighted  $r = -.014$ ), and a significance level of  $p = .94$ . The effect sizes from these two meta-analyses were significantly different,  $Z = 3.31$ ,  $p = .001$ .

When examining the two series of studies separately, only the studies that examined the processing of social categories yielded a significant effect (Rosenthal & Rosnow, 1991).<sup>5</sup> In contrast, the studies that examined broad essentialist lay theories about person attributes in general did not yield an overall significant effect, and the former's overall effect size was significantly larger than the latter's. We interpret this finding as evidence that the effects of fluid movement influence the processing of social categories but may not extend to influence broad essentialist lay theories about people in general. This also suggests that fluid movement influences the *processing* behind concepts under consideration (e.g., influencing the processing of race; see Levin & Angelone, 2002) rather than activating particular conceptual content (e.g., influencing the conceptual framework a person endorses to explain what a "person is like"; see Dweck, Chiu, & Hong, 1995). This differential influence is consistent with the prior suggestion that the current manipulations represent influences on cognitive processing rather than conceptual activation (see Slepian & Ambady, 2012).

The purpose of the current investigation was to examine the influence of fluid movement on essentialism. After combining the studies on social category outcomes with the studies that used the general person-attribute scale, the overall effect size was statistically significant (Rosenthal & Rosnow, 1991). Specifically, combining effect sizes and *p* values (following guidelines by Rosenthal, 1991), a meta-analysis of all studies, with a total sample size of 529 participants enacting or observing fluid or nonfluid movement yielded an overall effect size  $r = .147$  (sample-size weighted  $r = .145$ ), a significance level of  $p = .001$ , and a fail-safe number of 35 unresponsive studies that would be needed to change the combined significance level to nonsignificant. These findings indicate an influence of fluid movement on essentialism outcomes, with implications for essentialism and processing style.

## General Discussion

Essentialism is associated with rigid, fixed, and discrete representations of social categories, as reflected by perceivers' lay beliefs about the fixed nature of social groups (e.g., race) and in perceptions of rigid social category boundaries. In this respect, essentialist thinking about social categories resembles a *lack* of fluid processing of social categories, characterized by rigid, fixed, and discrete representations, rather than fluent, flexible, and broad representations. Indeed, in the current work, a domain-general fluid processing style, activated cross-modally, gave rise to fluid social-cognitive processing, reducing essentialist thinking about social categories.

In Study 1, fluid movement caused participants to explicitly endorse the belief that racial categories have fluid boundaries. In Studies 2 and 3b (although not Study 3a), fluid movement led participants to categorize racially ambiguous faces as Black *and* White (i.e., biracial) rather than only Black

or White, demonstrating that fluid, relative to nonfluid, movement minimized the perceived rigidity of social category boundaries. This reduction in essentialist thinking had consequences for stereotyping and ideology. In Study 4, observing fluid movement led participants to endorse social stereotypes about a variety of social categories less than participants who observed nonfluid movement. In Study 5, after reading about racial inequalities, enacting fluid movement caused participants to express increased concern for such inequalities. An additional series of studies examined person-level essentialism but found no effect of fluid movement on endorsing the belief that essences underlie person attributes, in general, suggesting perhaps, in this context, that these effects are specific to influences on processing social categories rather than activating a particular conceptual framework about what people are like in general. A meta-analysis demonstrated a reliable effect size for the effect of fluid movement on essentialist processing about social categories but not on essentialist thinking about people in general, and an overall meta-analysis on both series of studies yielded a significant effect.

Future work could explore other manipulations of fluid movement. For instance, perhaps certain types of dance or yoga could influence fluid processing by means of fluid movement. Or perhaps other types of observation could lead to similar effects, such as observing the movement of flowing liquids or observing performing artists move in a fluid manner. Alternatively, perhaps observing fluid movement will lead to fluid cognition only when those movements are in an observer's motor repertoire, similar to how dancers simulate observed actions of other dancers but only those who perform dances that they themselves are trained in (Calvo-Merino, Glaser, Grezes, Passingham, & Haggard, 2005). Finally, future work could examine other outcomes that vary by fluid processing, for example, perhaps fluid movement could influence categorization more broadly.

## Implications for Essentialism

The current research extends work on essentialism by demonstrating that activating fluid cognitive processing through sensorimotor activity can influence essentialist thought about social categories. Prior work that has manipulated essentialism has treated its outcomes as dependent on the activation of particular domain-specific content. This is reflected, for example, by prior manipulations of essentialism that require cognitive elaboration, such as asking participants to read and think about ostensible scientific articles regarding the biological basis of race. Yet, the current work demonstrates that essentialist thought about social categories can be influenced by manipulations that are devoid of any such cognitive elaboration. This opens the door for the development of interventions that reduce essentialist social cognition by inducing a domain-general manipulation of processing style that does not require specific mention of race or other social categories. Indeed, interventions that do mention race in an effort to



reduce essentialist thinking are often regarded as threatening (e.g., by White individuals; Plaut, Garnett, Buffardi, & Sanchez-Burks, 2011). Consequently, the results of the studies presented here suggest a new means to reduce essentialism and its consequences (e.g., stereotyping).

The current findings also dovetail with a recent set of studies examining cross-domain activation of cognitive processing style. That work demonstrated that prompting nonessentialist (i.e., race is socially constructed) beliefs as opposed to essentialist (i.e., race is biologically based) beliefs increased creativity in an unrelated task (Tadmor, Chao, Hong, & Polzer, 2013). Increasing fluid cognitive processing enhances creativity (Slepian & Ambady, 2012), and reducing essentialism also enhances creativity (Tadmor et al., 2013). In the current work, increasing fluid processing reduced essentialism. Our findings, together with other recent studies, suggest an interesting relationship between essentialism and creativity that might be driven by fluid processing.

### Implications for Processing Style Activation

Cognitive processing styles are generalized thought patterns, such that activating a processing style in one domain can influence cognition and behavior in another domain. That is, the same processing style can carry across many contexts, influencing cognition in multiple domains. These findings extend prior work on processing style by demonstrating that such processing styles can also be activated cross-modally and apply broadly to social cognition. Prior work has activated processing styles by requiring participants to cognitively elaborate (by reading or writing) on propositional information. In contrast, we demonstrate here that certain patterns of movement can activate corresponding patterns of thought, broadening our understanding of how processing styles are achieved and influence social cognition.

These findings add to work demonstrating that embodied states can influence social cognition (e.g., Slepian, Weisbuch, Rule, & Ambady, 2011; Slepian, Young, Rule, Weisbuch, & Ambady, 2012) by demonstrating that not only can sensorimotor states influence social cognition by means of conceptual activation, but also by means of processing style activation. The current research, therefore, also extends work on the embodiment of concepts, more generally. That is, while *concepts* are the central focus of social-embodied cognition thus far (e.g., Jostmann, Lakens, & Schubert, 2009; Miles, Nind, & Macrae, 2010; Schnall, Benton, & Harvey, 2008; Slepian, Masicampo, Toosi, & Ambady, 2012; for a review, see Meier et al., 2012), we demonstrate here, that in addition to concepts, processing styles applied to a variety of concepts can also be activated from bodily movement and sensation (see also Zarkadi & Schnall, 2013). While the current effects are likely not long-lasting, repeated fluid movement (e.g., via particular types of dance or yoga) may produce longer lasting influences. Future work could examine individuals who frequently enact fluid movement.

## Conclusion

The current work demonstrates that sensory states can influence cognitive processing style: Fluid movement promotes a fluid social-cognitive processing style, reducing essentialism. The body can fluidly move in multiple directions, and so can thinking, moving in multiple directions, eschewing rigid categorical boundaries, and allowing for a more fluid social cognition. Here, we demonstrate that such fluid movement promotes a fluid processing style in a domain with numerous consequences, beliefs and cognitions about social categories. Fluid movement led to fluid social-cognitive processing as evidenced by influences on lay theories about social categories, social categorization, stereotype endorsement, and concern for social inequalities.

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## Notes

1. In all our studies, we planned to collect at least 20 observations per condition and stopped data collection at convenience temporal landmarks (e.g., the end of the week, the end of a semester).
2. Although we did not have directional hypotheses regarding the remaining categorizations, this treatment effect must logically be reflected in reduced monoracial categorizations for the fluid condition. Participants who made fluid arm movements categorized faces as Black less often than those who made nonfluid arm movements ( $M_{fluid} = 4.30$ ,  $M_{nonfluid} = 6.50$ ),  $t(38) = 2.57$ ,  $p = .01$ . Categorizations of faces as White did not differ ( $M_{fluid} = 5.90$ ,  $M_{nonfluid} = 5.70$ ),  $t(38) = 0.44$ ,  $p = .67$ .
3. The online study did not prevent participants from clicking next to move forward to the race-categorization task before the video finished, nor did it force participants to complete the task immediately after watching the video. In addition, we suspected that some participants from this pool would be concerned with self-presentation regarding the categorization task if they felt that it was a measure of racial bias. For these reasons, we asked participants to describe the video at the end of study and timed how long they watched it and also gave them a final box to write any comments they had about the study (to examine whether, without prompt, they would indicate their suspicion that the study was examining racial prejudice). Our a priori exclusion criteria were therefore (a) providing evidence of not watching the full video,



- either by (a.1) not providing any concrete information about the video, or (a.2) not watching the entire video as indicated by the hidden timer on the question; (b) *not* moving directly from the video to the racial categorization task by letting a substantial amount of time pass (a minute or greater) after the video finished before clicking next to start the task (suggesting switching to another task during or after the video); and (c) approaching the racial categorization task as if it were designed to measure racial prejudice as indicated by volunteering that they suspected that the categorization task was a measure of racial bias (from the open-ended study comments box). In Study 3a, four participants met exclusion criterion (a.2), three participants met exclusion criterion (c), and one participant met exclusion criteria (a.2) and (c). In Study 3b, four participants met exclusion criterion (a.1), one participant met exclusion criterion (a.2), six participants met exclusion criterion (b), and four participants met exclusion criterion (c). Participants who met these a priori exclusion criteria were excluded from analyses (see Oppenheimer, Meyvis, & Davidenko, 2009). These a priori exclusion criteria were used in all Internet-based movement observation studies (Studies 3a-3b, Study 4, and Studies 6-9).
4. While we again did not make predictions for the specific pattern of monoracial categorizations, we present this data for the interested reader. In Studies 3a and 3b, there was no influence of observation of fluid movement on Black categorizations: Study 3a ( $M_{fluid} = 6.29$ ,  $M_{nonfluid} = 6.44$ ,  $M_{control} = 4.83$ ),  $F(2, 49) = 1.36$ ,  $p = .27$ ; Study 3b ( $M_{fluid} = 5.32$ ,  $M_{nonfluid} = 7.07$ ,  $M_{control} = 6.77$ ),  $F(2, 81) = 1.57$ ,  $p = .22$ . In both studies, there was no influence on White categorizations: Study 3a ( $M_{fluid} = 6.18$ ,  $M_{nonfluid} = 5.78$ ,  $M_{control} = 7.41$ ),  $F(2, 49) = 1.24$ ,  $p = .30$ ; Study 3b ( $M_{fluid} = 6.71$ ,  $M_{nonfluid} = 7.43$ ,  $M_{control} = 6.42$ ),  $F(2, 81) = 0.45$ ,  $p = .64$ .
5. Given that one of the studies that examined the processing of social categories yielded a nonsignificant finding, we also report a meta-analysis of the three studies that examined racial categorization for the interested reader. These studies, with 150 participants, yielded an overall effect size  $r = .22$  (sample-size weighted  $r = .21$ ), and a significance level of  $p = .007$ .

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