

# Control Deprivation and Styles of Thinking

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Westerners habitually think in analytical ways, whereas East Asians tend to favor holistic styles of thinking. We replicated this difference but showed that it disappeared after control deprivation (Experiment 1). Brief experiences of control deprivation, which stimulate increased desire for control, caused Chinese participants to shift toward Western-style analytical thinking in multiple ways (Experiments 2–5). Western Caucasian participants also increased their use of analytical thinking after control deprivation (Experiment 6). Manipulations that required Chinese participants to think in Western, analytical ways caused their sense of personal control to increase (Experiments 7–9). Prolonged experiences of control deprivation, which past work suggested foster an attitude more akin to learned helplessness than striving for control, had the opposite effect of causing Chinese participants to shift back toward a strongly holistic style of thinking (Experiments 10–12). Taken together, the results support the reality of cultural differences in cognition but also the cross-cultural similarity of using analytical thinking when seeking to enhance personal control.

*Keywords:* control deprivation, holistic thinking, analytical thinking, cultural difference, learned helplessness

All human brains may be born with the same basic design, but not all humans think in the same way. Styles of thinking are learned from the social and cultural environment. Evidence of cultural differences in thinking has accumulated in recent years. In particular, East Asians tend to think holistically, in contrast to the analytical style of thought favored by Westerners (Nisbett, Peng, Choi, & Norenzayan, 2001). The East Asian, holistic style of thought spreads attention across objects, background, and relationships, whereas the Western analytical style attends mainly to individual objects. Holistic thinking emphasizes wholes and dialectics, changing and flowing states, and relationships. In contrast,

analytical thinking emphasizes logic, constant or stable states and properties, and categories defined by strict rules.

But why? Some explanations for the cultural differences in thinking have focused on the discrepant heritages due to historical accident: Ancient Chinese philosophers developed styles of thinking that differed from those of ancient Greek philosophers, and these orientations influenced their respective civilizations over the centuries (Nisbett et al., 2001). Certainly historical influence may be one contributing factor, but the persistence of differences across centuries has likely been mediated by more immediate psychological factors. Indeed, the reason why anyone would favor one style of thought over another is a fundamental but difficult question. The present research tested hypotheses and predictions on the basis of the assumptions that a basic purpose of thought is control and that analytical thinking is advantageous for control. Specifically, we built on evidence that the typical desire for personal control is lower among East Asians than among Westerners. Indeed, differences in the sense of personal agency have been identified as among the largest and most important cultural differences (Kashima et al., 1995). If the drive for personally agentic control is less pronounced among East Asians than Westerners, then stimulating the desire for control should make East Asians think in more typically Western (i.e., analytical) fashion.

One means of stimulating the desire for personal control is to give people brief experiences of blocked or thwarted control. Ample evidence has indicated that when people are deprived of control, their first response is to seek to reassert control. This pattern has been shown in multiple contexts, such as reactance (Brehm, 1966). Hence, we proposed that brief experiences of control deprivation would cause East Asians to adopt more West-

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ern styles of thinking. This was the central hypothesis of the present investigation.

### Culture and Cognition

A theory of cultural differences in cognition was put forward by Nisbett and his colleagues, and this has received good empirical support (see [Nisbett & Masuda, 2003](#); [Nisbett et al., 2001](#)). It proposes a broad difference in thinking between East Asian cultures, such as Japan and China, and Western civilizations, such as Europe and North America. These differences are subsumed under the rubric of analytical versus holistic thinking, with East Asians thinking holistically and Westerners thinking analytically. The differences are assumed to be relative matters of emphasis rather than absolute differences of capability ([Caldara, Zhou, & Mielliet, 2010](#); [Mielliet, Zhou, He, Rodger, & Caldara, 2010](#)). Moreover, this approach assumes that both styles of thought are available and possible for anyone, and so the differences arise from preferences, habits, and emphases. This point is relevant to the present investigation because it entails that despite their cultural background, Chinese people could think analytically if they were motivated to switch from their normal, holistic style.

The cultural groups differ in how they allocate attention. The analytical style focuses on individual objects, mentally separating them from their context and background. The holistic style, in contrast, sustains the connections between objects and context and, indeed, regards those connections as vital. For example, [Masuda and Nisbett \(2001\)](#) found that Japanese participants were less likely than Americans to recognize a previously seen object in a different context, such as when they saw two photos of the same wolf with a different background. Eye-tracking research has confirmed that Americans attend mainly to the foreground object in a picture, whereas East Asians shift their gaze between the foreground object and the background ([Chua, Boland, & Nisbett, 2005](#); [Masuda et al., 2008](#)).

Holistic styles of thought emphasize relationships and connections, and so holistic thinkers tend to categorize things in terms of how they are associated with each other, such as functional relationships (e.g., [Ji, Zhang, & Nisbett, 2004](#); [Knight & Nisbett, 2007](#)). In contrast, analytic thinking emphasizes the individual object and its properties, and so, Westerners tend to categorize things based on conceptual rules about specific characteristics of the object, independent of what may happen to come with it.

Holistic thinkers see events as constantly changing, whereas those using analytical approaches think in terms of stable properties and principles. Analytical thinkers can therefore maintain sharp distinctions and recognize contradictions, whereas holistic thinkers may assume that contradictions will be reconciled and may in other ways be more tolerant of inconsistency ([Peng & Nisbett, 1999](#)). Dialectical thinking, in which contradictions are resolved through change, would be more compatible with holistic thinking than analytical thinking ([Heine & Ruby, 2010](#)). Another consequence of this difference is that Western analytical thinkers will favor linear extrapolation and therefore predict future events as continuing linear trends, whereas Asian holistic thinkers will tend to make nonlinear predictions, such as assuming that trends will reverse so as to balance out ([Ji, Nisbett, & Su, 2001](#)).

In the present research, we assume that East Asian participants would normally think in all these holistic ways but are capable of

switching to the analytical styles. Alongside the evidence of cultural differences in cognition, other evidence has accumulated to show that these differences are not set in stone but rather are often responsive to situational influences. [Oyserman and Lee \(2008\)](#) reviewed abundant evidence that the collectivism–individualism difference is highly malleable: Both Asians and Westerners are capable of shifting toward more individualistic and to more collectivistic styles of thinking, often stimulated by such subtle primes as having participants read a story about a Sumerian warrior selecting a leader based either on skill or on family connections or having them circle singular or plural pronouns. These manipulations have altered the values participants express, how they relate to others, and how they describe themselves. Other studies have shown that cultural differences in cognition can change as a function of time pressure ([C.-Y. Chiu, Morris, Hong, & Menon, 2000](#)), salience of relevant norms ([Kim, Chiu, Peng, Cai, & Tov, 2010](#)), salience of cultural identity ([Oyserman, Sakamoto, & Lauffer, 1998](#)), personality differences in need for closure ([C.-Y. Chiu et al., 2000](#); [Fu et al., 2007](#)), degree of perceived consensus within one's cultural group ([Zou et al., 2009](#)), and relative salience of one or another culture (especially to bicultural individuals; [Hong, 2009](#); [Zou et al., 2009](#)).

As [Oyserman and Lee \(2008\)](#) observed, studies of moderators of the effects of culture and cognition accomplish more than demonstrating the existence of variation: They enable researchers to build theory by identifying specific variables that cause changes in cognition, in contrast to the initial demonstrations of cultural differences, which often leave unresolved the question of why people in one country might respond differently from people from a different country. The present research was inspired by the same interest in building on findings of cultural differences by illuminating some of the variables that contribute to them. Our experiments measured an assortment of culturally relative thinking tendencies under normal conditions and under conditions that could motivate people to change.

### Control, Cognition, and Deprivation

Why does thinking occur? In evolutionary perspective, all adaptations facilitate survival and reproduction. Toward those ends, organisms must interact productively with their environment. Control can be seen as the process by which individuals achieve a beneficial harmony with their environment. This can take the form of changing the environment to suit the self or changing the self to suit the environment ([Rothbaum, Weisz, & Snyder, 1982](#)). Broadly put, then, the function of thought is to help these processes, so that optimal behaviors can be chosen. Thus, we assume that one general function of thinking is that it facilitates control. If so, then control motivations could influence cognitive patterns.

Primary control means changing the environment to suit the self, typically through making specific changes by acting on external objects. To do that successfully, one must focus on the specific object or site that is to be altered and then understand the stable principles by which it is governed. Science and technology have proven successful at altering the external environment precisely by engaging in systematic observation so as to deduce general, stable, abstract laws that operate consistently; predicting how the natural environment operates; and applying them logically. These are the hallmarks of analytical thought. It cultivates a precise understand-

ing of objects and unchanging principles (Rothbaum et al., 1982). It assumes that one can extrapolate in a straightforward, usually linear manner from existing knowledge and previous situations to predict precisely what to expect next, so as to use that knowledge as a basis for control. Thus, analytical thought is suited to primary control.

In contrast, secondary control means changing the self to suit the environment, which calls for a different pattern of thinking. Morling and Evered (2006) extended the Rothbaum et al. (1982) theory by demonstrating that secondary control involves two sorts of processes: acceptance and adjustment. Acceptance requires the self to see what is there and relinquish emotional or motivational reactions that involve wishing it were different. Adjustment means making whatever alterations in the self are necessary to achieve fit with the environment. Holistic thinking is better suited than analytical thinking for accomplishing these ends. In order to accept and adjust oneself to the environment, it is useful to focus attention on all of the environment, including the background. After all, it would be futile to accept only the foreground and not the background. Insofar as the goal of secondary control is to fit the self into the environment, it is necessary to understand relationships among all entities present, including the self, the background, and the foreground objects. Therefore, a heightened focus on relationships and interactive groupings rather than abstract rules would be most useful. The secondary controller has less need than the primary one to use stable principles and consistent laws, and indeed, acceptance may be made easier by flexibly anticipating that circumstances may change and trends may mysteriously reverse themselves. In short, holistic thinking seems suitable for acceptance and adjustment (secondary control).

Perceived control is almost certainly linked more to primary than secondary control. What people understand and feel as having control refers to their ability to change the environment as they wish. Skinner (2007) questioned whether secondary control should even be classified as control at all, and her answer was that it comprises several different sorts of phenomena, some of which are not control and some of which may be. Indeed, she argued that secondary control, as Morling and Evered (2006) analyzed it, as achieving fit between the self and the environment, is not really control (p. 911).

Therefore it seems reasonable to assume that perception of control is mainly about primary control. When people experience a deficit in perceived control, it is normally because their efforts to exert primary control (i.e., to change the environment) have been blocked. They may respond by seeking primary control, that is, to reassert their ability to change the environment. That failing, they may turn to acceptance and adjustment. Acceptance is not the same as regaining control; however, it is accepting things as they are, as beyond one's capacity to change them. Adjustment may involve control insofar as one changes the self to fit in, but it too presumably feels quite different from changing external circumstances to suit oneself.

### Cultural Differences

Precisely why Chinese and other East Asians typically favor holistic thinking and secondary control, while Westerners have come to favor analytical thinking and primary control, may be an

issue better addressed by cultural anthropologists and historians than by experimental psychologists. There appears to be broad agreement that in collectivistic Asian cultures, "secondary control appears to be relatively more elaborated, practiced, and valued" (Morling & Evered, 2006, p. 289). Some explanations invoke differing cultural heritages, such as Confucian versus ancient Greek (e.g., Aristotelian) philosophy. Others might look to the different social systems. Analytical thinking may have been associated with the rise of individualism in the West, which was linked to economic and social mobility stimulated in part by the competition among many relatively small countries. During those same historical periods, China had achieved centralized imperial power—which resisted the destabilizing influences of social and technological innovation (McNeill, 1982, 1991). Hence, it is fair to speculate that while Western cultures feverishly sought primary control amid intense local competition, China and other Asian cultures favored acceptance of and adjustment to the status quo.

Collectivist societies tend to discourage self-assertion (e.g., Kashima et al., 1995), and so secondary control becomes an important social norm. Self-assertion puts the self above the group and therefore threatens group harmony, which is a supreme value in collectivistic societies. In those societies, children learn from early in life to submit to the authority of parents and other elders. So-called secondary control may even cease to be secondary (Skinner, 2007). Weisz, Rothbaum, and Blackburn (1984) proposed that Asian (Japanese) citizens favor secondary control in general (see also Morling & Evered, 2007). Fate in particular is seen as oscillating between good and bad outcomes, so that it is important to expect and accept reversals of fortune, contrary to the Western pattern of linear extrapolation.

The link between control and cultural style of cognition led us to formulate the core hypothesis behind the present work, which is that stimulating an individual motive for primary control would cause East Asians to shift toward the Western style of cognition. The holistic style of cognition may arguably be better suited to the East Asian way of life and its traditional values in general. However, when an individual from any culture needs to assert or establish direct control over the environment, an analytical style of thinking may be the most useful and, hence, the most appealing one.

Past work has thus contended that East Asians generally are inclined to accept things as they are and adjust themselves, whereas Westerners seek to change the world to suit themselves. Our work proposed, however, that these habits are not ironclad but flexible and that in particular people from both Asian and Western cultures may resort to analytical thinking when they wish to exert primary control over the environment.

In order to stimulate the motivation for control, we used procedures involving control deprivation. As with many motivations, the desire for control seems to increase when it is thwarted. For example, reactance theory proposed that people seek to reassert behavioral options that have been blocked or restricted by external forces (Brehm, 1966). Control deprivation likewise intensifies efforts at cognitive control (e.g., Liu & Steele, 1986; T. S. Pittman & Pittman, 1980; Swann, Stephenson, & Pittman, 1981). Even the frustration-aggression hypothesis can be viewed as indicating a desire to reclaim control when one's goal-directed strivings have been blocked (see Dollard, Doob, Miller, Mowrer, & Sears, 1939; Miller, 1941).

### Brief and Long Deprivations

To be sure, the drive to assert control does not increase indefinitely as a linear function of control deprivation. Severe experiences of deprivation have been shown to produce the opposite effects. The most notable of these exceptions is work on learned helplessness, a phenomenon in which humans or animals respond to control deprivation by ceasing to make efforts to exert control and even ceasing to learn contingencies (Seligman, 1975). From the perspective of more recent theory (Morling & Evered, 2006), learned helplessness achieves fit by extreme acceptance and perhaps some adjustment, after relinquishing efforts at primary control.

An influential theory by Wortman and Brehm (1975) sought to integrate reactance findings with learned helplessness. Those authors proposed that small or brief deprivations of control lead to efforts to reassert control, whereas more prolonged or severe experiences cause people to give up and cease seeking control. That same year, an experiment by Roth and Kubal (1975) provided evidence that the effect of control deprivation on subsequent performance was curvilinear. Some participants performed one concept-formation task that was rigged to be unsolvable. Others performed an extended series of such problems, being told each time (thus after each failure) that the next one would be easier. Both self-report and behavioral performance measures indicated that the single helpless experience increased control seeking, whereas the multiple helpless experiences decreased it, especially when the task was seen as important.

Subsequent work provided further evidence to support the curvilinear relationship between control deprivation and subsequent efforts to establish control. N. L. Pittman and Pittman (1979) showed that brief periods of control deprivation caused some people (with internal locus of control) to perform better on a subsequent task, whereas longer and more thorough experiences of lacking control caused such people to perform poorly. Brockner et al. (1983) showed that many participants performed better on anagrams task after initial small failure but worse after extended initial failure. Baum and his colleagues (Baum, Aiello, & Calestnick, 1978; Baum & Gatchel, 1981) showed that being assigned to crowded dormitory conditions led initially to reactance but later to signs of helplessness.

Indeed, the idea that continued experiences of control deprivation produce quite different responses was implicit in the primary–secondary distinction made by Rothbaum et al. (1982). The primary approach according to their conceptualization is that people seek to alter the world to suit the self, and if that fails, the person switches to the secondary approach, which is to alter the self to suit the environment. Insofar as analytical thinking is optimal for controlling the environment, it would be suited to the first step but may lose some of its motivational allure after prolonged failures of direct control. Therefore, we predicted that initial experiences of control deprivation would cause an increase in analytical thinking, but further accumulating experiences of lack of control would lead to a shift toward holistic thinking.

### Plan of Present Research

The present investigation was designed to test the hypothesis that small (though not large) doses of control deprivation would

motivate East Asians to think more like Westerners, which is to say in an analytical rather than holistic manner. The 12 studies reported herein can be grouped according to several steps in providing relevant evidence.

Control deprivation was manipulated in two ways. In some experiments, we sought to activate a state of mind associated with control or lack of it by having people recall important, vivid experiences from their personal lives. Half wrote about an experience in which they felt a complete lack of control, whereas the rest wrote about experiences in which they felt fully in control of the situation. In the other manipulation, we had people perform a concept formation task. Half received random feedback on a trial-by-trial basis, designed to make them have a mixture of successes and failures such that these were not predictable enough to furnish a feeling of mastery or genuine control. The rest received no feedback.

The responses of East Asians and Westerners were compared against each other in Experiment 1. The goals of that study were to replicate the usual difference in thinking styles, in this case, attending to the foreground object versus the background—and then to show that depriving people of control would eliminate that difference. East Asians would normally focus on the background more than would Westerners, but after being deprived of control, East Asians would shift toward more exclusive attention to the foreground object.

Experiments 2–5 focused on cognitive changes resulting from control deprivation among East Asian participants. These included shifting toward favoring logical rather than dialectical arguments (Experiment 2), categorizing items by abstract rules instead of family resemblance (Experiment 3), relying on strict logical rules instead of resemblance (Experiment 4), and expecting consistency rather than change (Experiment 5). In Experiment 6, we sought replication with a Western sample.

The sense of control became a dependent variable in the next group of studies. These manipulated thinking style by instructing participants to look at a foreground object versus the background (Experiment 7) or by having them classify objects by abstract rules versus by resemblance and relationships (Experiments 8 and 9). The goal was to show that thinking in the Western, analytical style would indeed increase sense of control among East Asians.

Last, we undertook to show that extended experiences of control deprivation would produce effects quite different from brief ones, on the assumption that the first response to control deprivation is to try harder to exert control, whereas prolonged or repeated experiences of lacking control would cause people to give up. They measured tendencies to attend to the foreground or the background (Experiment 10), to categorize by abstract rules versus resemblance and relationships (Experiment 11), and to make linear versus trend reversing predictions (Experiment 12).

### Experiment 1

Our first experiment compared Western and Chinese participants in terms of visual focus of attention. We showed participants a variety of pictures and used an eye tracker to assess how much they looked at the central, prominent object in the center of the picture, as opposed to looking at the background. Past work has indicated that East Asian participants tend to look at backgrounds

more than do Westerners (Chua et al., 2005). We sought to replicate that effect. More importantly, we tested the hypothesis that a brief experience of control deprivation would cause East Asians to focus more extensively on the object in the foreground, as Westerners do. The prediction was therefore that control deprivation would cause East Asians to manage their attention in the more characteristically Western manner.

Control deprivation was manipulated with a procedure that has been used in many previous studies (e.g., Chaiken, Liberman, & Eagly, 1989; N. L. Pittman & Pittman, 1979; T. S. Pittman, 1993; T. S. Pittman & D'Agostino, 1989; Whitson & Galinsky, 2008). Specifically, participants were presented with pairs of figures and instructed to indicate which member of the pair fit a concept (that had not been specified). The task was thus to figure out the concept. Initial responses must necessarily be guesses. In the no-feedback condition, participants were never told whether their guesses were correct or not, and so they continued to guess throughout the task. In the control deprivation condition, participants were provided with bogus (random) feedback. That created the impression that by learning from the feedback, the participant should be able to figure out gradually what the concept was and therefore converge increasingly on right answers. However, the randomness of the feedback would instead convey to the participant that he or she was repeatedly failing to learn the concept. Sometimes the participant was told that his or her answer was correct, which would presumably increase hope and confidence, which would then be dashed when he or she was told that subsequent answers were wrong. The goal was to create a growing sense of frustration and lack of control by repeatedly creating and then demolishing the feeling that one was making progress toward learning the concept.

## Method

**Participants.** Forty-eight Chinese (17 male, 31 female) students in Guangzhou, China, and 48 Caucasian (34 male, 14 female) students from various Western countries (i.e., the United States, Germany, Russia, France, Canada, and United Kingdom) took part. Each was paid 15 RMB (renminbi, approximately U.S.\$2.40) or given a gift for taking part. All participants had normal vision or wore glasses that corrected to normal acuity.

**Procedure.** During the first task, participants were presented with 10 pairs of figures in each block (four blocks totally). These figures were letters that vary in five dimensions: different letters, uppercase or lowercase, red or black, with dotted underline or with solid underline, and with circle frame or with square frame. Participants were instructed to identify which figure was the correct instance of a conceptual rule that they were expected to infer. In the no-feedback condition, the participants did not get any feedback on whether their answers were correct. In the control deprivation condition, the participants did get feedback on whether their answers were correct or incorrect, but the feedback was randomly determined and, thus, not contingent on the participant's answers.

The second task was ostensibly unrelated to the first. It involved viewing a series of 36 pictures, presented for 3 s each. An eye-tracking device recorded where and how the participant looked. The foregrounds of the pictures each contained one prominent object, including 20 animals and 16 inanimate objects. Back-

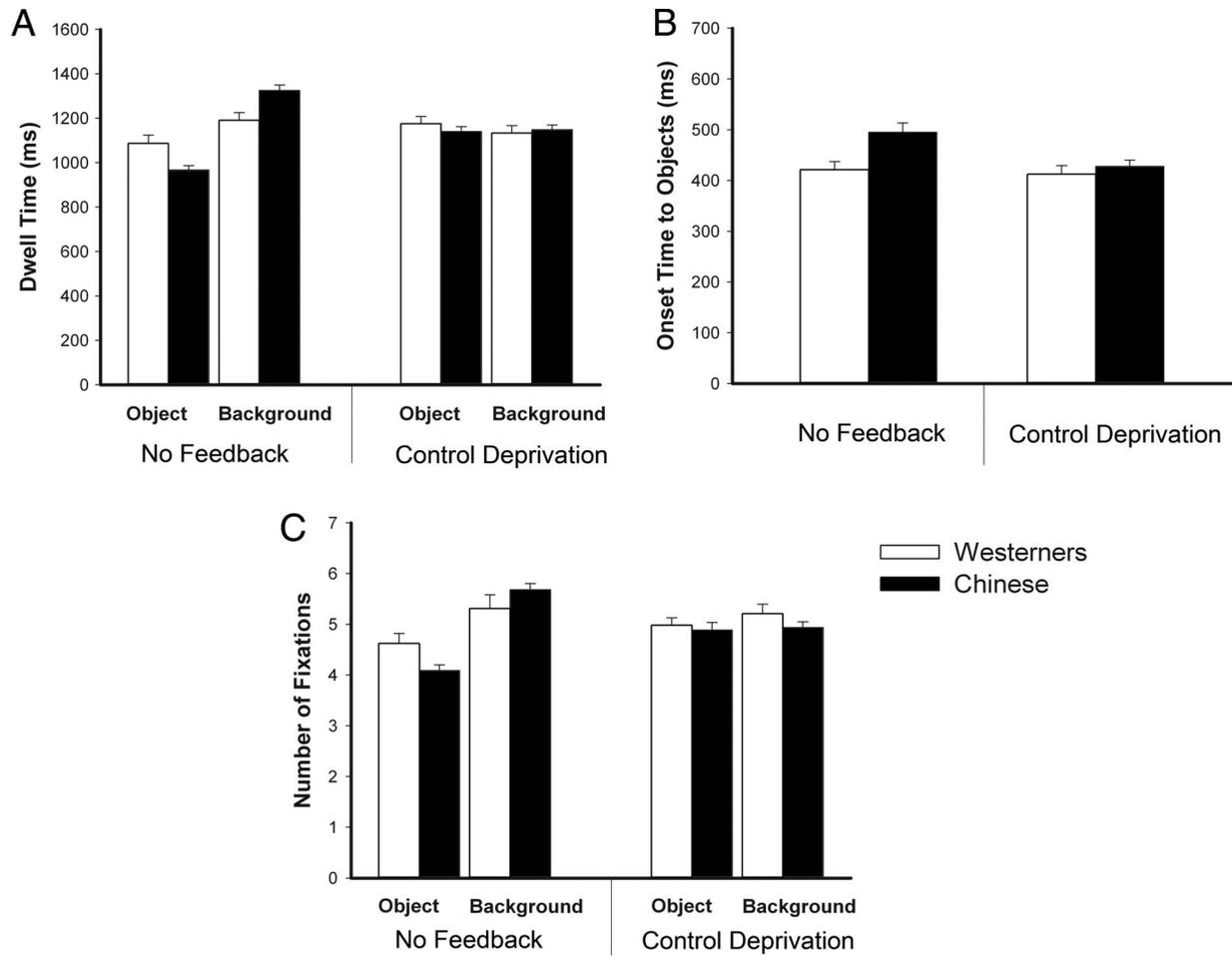
grounds were realistic, complex, and appropriate. These pictures were the same ones used in Chua et al. (2005). After the experiment had begun, the procedure was augmented by administering the Positive and Negative Affectivity Scale (PANAS; Watson, Clark, & Tellegen, 1988) to assess mood. This was given right after the picture viewing task finished to the final 41 Chinese and 31 Western participants.

## Results

Eye tracking data yield multiple measures. In the no-feedback condition, these patterns all confirmed the hypothesis that Westerners look at foreground objects more than do Chinese (see Figure 1) participants. First, dwell time is the sum of all fixations. Westerners dwelled on the foreground objects more than did Chinese participants ( $M = 1,088$  ms,  $SD = 181$  ms vs.  $M = 967$  ms,  $SD = 95$  ms),  $F(1, 92) = 9.05$ ,  $p = .003$ ,  $\eta_p^2 = .10$ . Second, Chinese participants dwelled on the backgrounds more than did Westerners ( $M = 1,326$  ms,  $SD = 117$  ms vs.  $M = 1,191$  ms,  $SD = 167$  ms),  $F(1, 92) = 11.24$ ,  $p = .001$ ,  $\eta_p^2 = .12$ . Third, Westerners fixated on the central foreground objects more frequently than did Chinese participants ( $M = 4.62$ ,  $SD = 0.99$  vs.  $M = 4.09$ ,  $SD = 0.54$ ),  $F(1, 92) = 5.82$ ,  $p = .018$ ,  $\eta_p^2 = .06$ . Last, onset time to objects consists of how long it took from the initial presentation for the participant to focus his or her gaze on the foreground object in the foreground. Westerners were faster than Chinese were to do this ( $M = 421$  ms,  $SD = 81$  ms vs.  $M = 495$  ms,  $SD = 90$  ms),  $F(1, 92) = 10.42$ ,  $p = .002$ ,  $\eta_p^2 = .11$ .

Crucially, all these cultural differences vanished in the control deprivation condition, ( $F_s < 1$ ,  $ns$ ). Thus, as predicted, the cultural differences in preferred style of attentional control were replicated in the no-feedback condition but were eliminated in the aftermath of an experience of loss of control. The elimination of the cultural differences was also evident when we examined the fixation patterns across the 3 s duration of picture presentations. As Figure 2 shows, the differences between cultural groups in the right panels (control deprivation) were not as pronounced as those in the left panels. The interaction effect between culture and control deprivation was significant in terms of dwell time on backgrounds,  $F(1, 92) = 4.53$ ,  $p = .04$ ,  $\eta_p^2 = .05$ . In terms of fixation on backgrounds and onset time to objects, the interaction effect was marginally significant,  $F(1, 92) = 3.05$ ,  $p = .08$ ,  $\eta_p^2 = .03$ ; and  $F(1, 92) = 3.25$ ,  $p = .08$ ,  $\eta_p^2 = .03$ . For all other indexes, the interaction effect was not significant.

The theory specifically predicted that control deprivation would cause Asian participants to change so as to attend more to foreground objects. This prediction was confirmed by comparing the eye movements of Chinese participants in the two conditions (see Figure 1). Compared with the no-feedback group, control deprivation caused Chinese participants to dwell more on the foreground object ( $M = 967$  ms,  $SD = 95$  ms vs.  $M = 1,140$  ms,  $SD = 104$  ms),  $F(1, 92) = 18.72$ ,  $p < .001$ ,  $\eta_p^2 = .20$ . It made them come faster to their first focus on the foreground object ( $M = 495$  ms,  $SD = 89$  ms vs.  $M = 428$  ms,  $SD = 61$  ms),  $F(1, 92) = 8.53$ ,  $p = .004$ ,  $\eta_p^2 = .09$ , and it made them look more frequently at those foreground objects ( $M = 4.09$ ,  $SD = 0.54$  vs.  $M = 4.88$ ,  $SD = 0.73$ ),  $F(1, 92) = 13.11$ ,  $p < .001$ ,  $\eta_p^2 = .14$ . Accordingly, it also made them dwell less on the background ( $M = 1,326$  ms,



*Figure 1.* A: Total fixation duration to the foreground object or background by Westerners and Chinese in the no-feedback conditions (baseline groups) and control deprivation conditions (experimental groups). B: Fixation onset time to the foreground object by the four groups. Time was measured from the onset of each picture to the first fixation to the object. C: Number of fixations to the foreground object or background by the four groups. All figures represent mean scores and standard error across 36 trials.

$SD = 117$  ms vs.  $M = 1,148$  ms,  $SD = 107$  ms),  $F(1, 92) = 19.53$ ,  $p < .001$ ,  $\eta_p^2 = .21$ .

Western participants also responded to control deprivation with an increase in attention to the foreground object, though not as reliably as the Chinese participants. Compared with the no-feedback control condition, Westerners in the control deprivation condition dwelled more on the foreground object ( $M = 1,088$  ms,  $SD = 181$  ms vs.  $M = 1,177$  ms,  $SD = 156$  ms),  $F(1, 92) = 4.95$ ,  $p = .03$ ,  $\eta_p^2 = .05$ . Onset time decreased ( $M = 421$  ms,  $SD = 81$  ms vs.  $M = 412$  ms,  $SD = 83$  ms), and frequency (count) of fixations increased, but not significantly ( $M = 4.62$ ,  $SD = 0.99$  vs.  $M = 4.98$ ,  $SD = 0.72$ ).

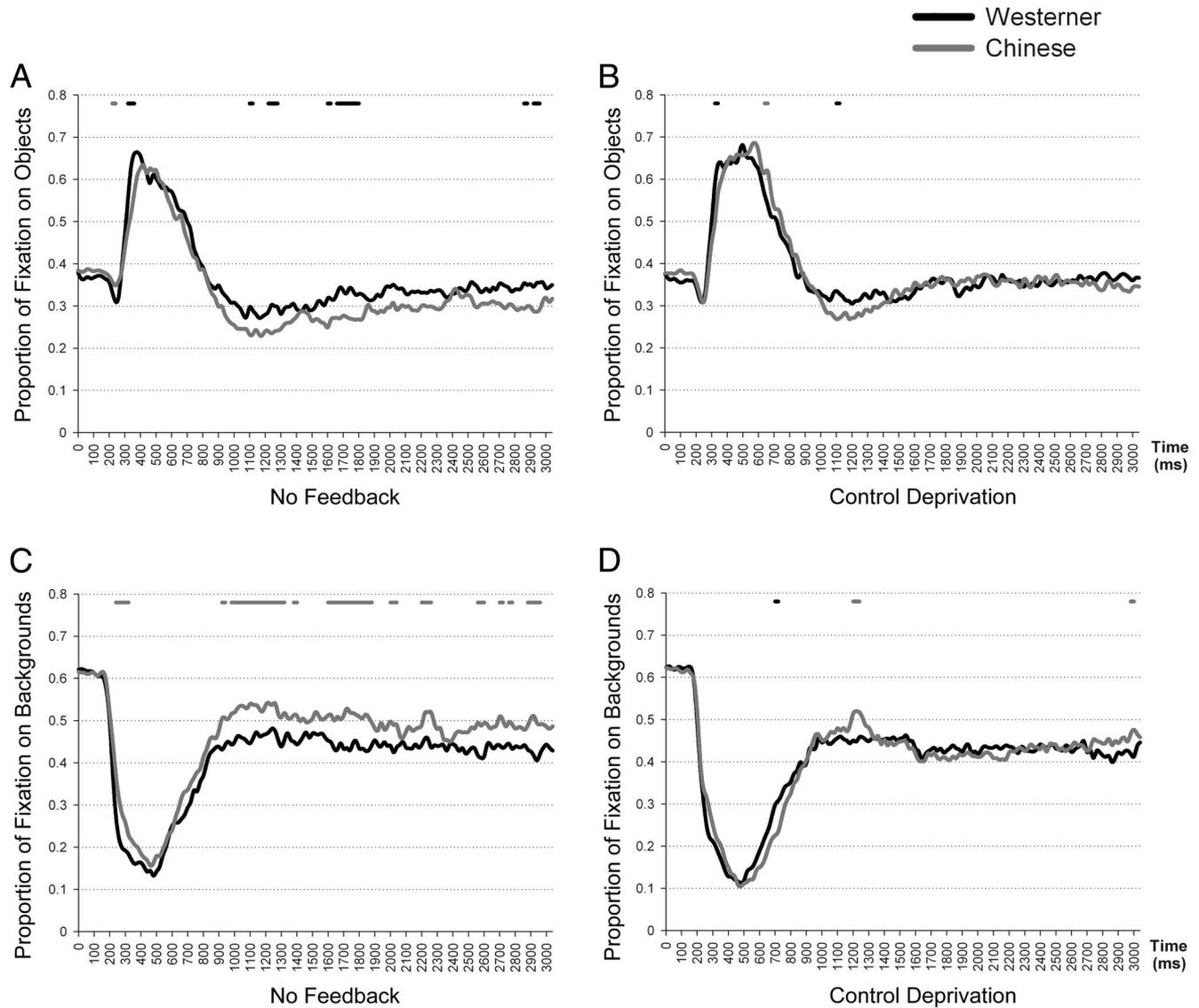
The PANAS assessed mood on the last 72 participants. There were no significant differences on mood between the control-deprived group and the no-feedback group, for Chinese participants,  $t_{\text{negative}(39)} = -0.11$ ,  $p = .92$ ;  $t_{\text{positive}(39)} = 1.89$ ,  $p = .07$ , and for Westerners,  $t_{\text{negative}(29)} = 1.25$ ,  $p = .22$ ;  $t_{\text{positive}(29)} = 0.28$ ,  $p = .78$ . For the negative affect items, Chinese participants did not differ between the no-feedback and control deprivation

conditions. Western participants in the control-deprivation group rated themselves as less “jittery” ( $M = 1.46$ ,  $SD = 0.59$  vs.  $M = 2.04$ ,  $SD = 1.08$ ),  $F(1, 46) = 5.38$ ,  $p = .03$ ,  $\eta_p^2 = .11$ , and less “scared” ( $M = 1.38$ ,  $SD = 0.77$  vs.  $M = 2.08$ ,  $SD = 1.25$ ),  $F(1, 46) = 5.60$ ,  $p = .02$ ,  $\eta_p^2 = .11$ , than the no-feedback Western participants.

## Discussion

We replicated the standard pattern that Westerners focus their gaze on the object in the foreground, whereas East Asians pay more attention to the background—under normal conditions. The difference in attending to the foreground object was evident in total looking time, number of looks at it, and speed to first focusing on it.

More importantly, we showed that these differences disappeared after an experience of control deprivation. Some participants received random feedback designed to instill a sense of frustration and of being unable to infer the correct concept, to *figure out what*



*Figure 2.* Proportion of fixations to object or background, across the 3 s time course of a trial in the no-feedback conditions (baseline groups) and control deprivation conditions (experimental groups). Data points were sampled every 20 ms, averaging over 36 trials. Significant differences at each time point across the two groups of observers are indicated by a dot at the top. A: Proportion of fixations on the object in the no-feedback conditions. B: Proportion of fixations on the object in control deprivation conditions. C: Proportion of fixations on the background in the no-feedback conditions. D: Proportion of fixations on the background in control deprivation conditions.

was going on, as it were. Afterward, both East Asians and Westerners showed the typically Western style of attention, involving heavy focus on the prominent object in the foreground. The convergence was entirely due to increased attention on the foreground object by East Asian participants. Westerners did not respond to control deprivation by shifting their attention to the background—in fact, on one measure they showed a significant increase in attention to the foreground object (though the Chinese in that condition increased by an even larger amount, thereby eliminating any significant difference).

## Experiment 2

The next set of experiments (2–5) was designed to manipulate control deprivation and to show that East Asian participants shifted toward analytical styles of cognition. In Experiment 2, we manipulated control deprivation with an autobiographical recall task. Participants were asked to describe an incident from their lives, and the exercise versus the deprivation of control was manipulated. Such manipulations create a mindset congruent to the experience being recalled (in this case, of enjoying or lacking control) and are

therefore an effective way of studying the effects of different mental states.

The dependent measure was preference for type of argument. Participants had to indicate a preference between two arguments. One applied naive dialecticism, based on the principle of holism, in which all things are assumed to be interrelated. Such arguments are more common in East Asian than in Western cultures. The other argument used Western-style analytical reasoning, invoking the principle of noncontradiction (i.e., that consistent premises cannot justify contradictory or incompatible conclusions). The prediction was that the East Asian participants would favor the analytical arguments more after recalling control deprivation than after recalling an exercise of control.

## Method

**Participants.** Fifty-four participants (28 female, 26 male) took part and were randomly assigned between the two conditions. All were Chinese students at Sun Yat-Sen University, with mean age 23 years. They received 5 RMB (approximately U.S.\$0.80) for taking part.

**Procedure.** Upon arrival, participants were told they would participate in two separate, unrelated studies. Their first task constituted the manipulation of control, adapted from Whitson and Galinsky (2008). In the control deprivation condition, they were given the following instructions:

Please recall a particular incident in which something happened and you did not have any control over the situation. Please describe in detail the situation in which you felt a complete lack of control—what happened, how you felt, etc.

In the high control condition, their instructions were as follows:

Please recall a particular incident in which something happened and you were in complete control of the situation. Please describe in detail the situation in which you felt in complete control—what happened, how you felt, etc.

**Logical and dialectical arguments.** Participants were next presented with two pairs of arguments. Each pair contained one analytical (logical) and one dialectical (holistic) argument. These arguments were adapted from Fisher (1988) and used by Peng and Nisbett (1999, Experiment 4) to measure cultural differences in preferences for argument type. Both arguments advocated the same conclusion. For example, the first pair of arguments concerned the falsity of Aristotle's assumption that a heavier object falls faster than a lighter one. The logical argument was a modern version of Galileo's thought experiment: Suppose the heavier object H was tied on top of the lighter object L; according to Aristotle's assumption, H + L as a joint entity should fall faster than H alone. However, in the joined entity, L below the heavier H should slow down H, making H + L fall slower than H alone. The logical argument concluded that the contradictory implications reveal Aristotle's assumption to be false. The dialectical argument applied the principles of holism and emphasized the importance of contexts. The holistic argument suggested that because Aristotle isolated objects from possible surrounding factors (e.g., wind, weather, and height), his initial assumption must be wrong.

The two arguments were similar in length, verbal style, and structure, and they reached the same conclusion. The difference between them lay in the style of reasoning. Participants responded to each pair by answering two questions: "Which argument is more persuasive (convincing) to you personally?" and "Which argument do you like more?"

## Results and Discussion

Participants in the control-deprivation condition showed a preference for logical arguments rather than dialectical arguments, as compared with participants in the high-control condition (see Figure 3). Participants' responses to four questions (two each about two pairs of arguments) produced consistent results: Those in the control-deprivation condition preferred logical arguments rather than dialectical arguments across all four questions (89%, 96%, 48%, 41%), more than those in the control group (56%, 52%, 19%, 15%),  $\chi^2$ s(1, 54) = 7.48, 13.89, 5.33, and 4.52;  $ps = .01, .01, .02, \text{ and } .03$ ;  $\phi = .37, .51, .31, \text{ and } .29$ .

In summary, Experiment 2 showed that compared with those recalling a high-control event, participants recalling a lack-of-control event increased their preference for formal logic instead of dialectical reasoning.

## Experiment 3

Experiment 3 examined means of categorization. The Western, analytical style of thinking favors categorization based on abstract rules, such as a single feature that is common to all members of the category. The Asian, holistic style and intuitive thinking styles often group things by family resemblance (e.g., Norenzayan, Smith, Kim, & Nisbett, 2002), such as sharing several features with each member of a group but not necessarily any single feature that is common to all members. The prediction for Experiment 3 was that control deprivation would cause East Asian participants to shift toward categorizing based on rules.

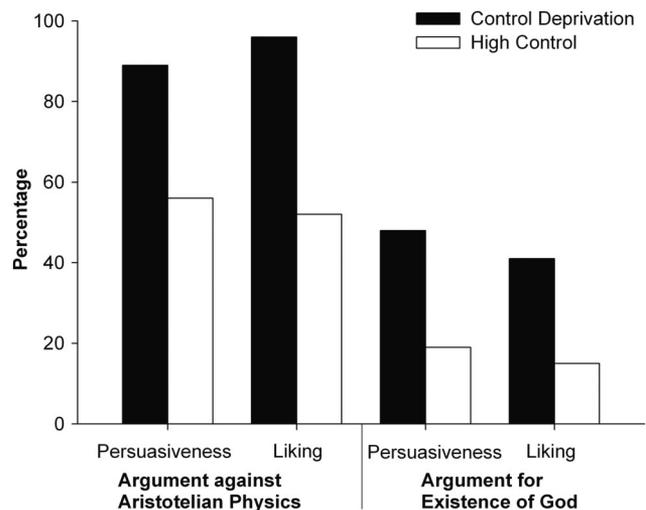


Figure 3. Percentage of participants preferring logic arguments in Experiment 2.

## Method

**Participants.** Sixty students (29 male, 31 female) from Sun Yat-Sen University participated in this experiment ( $M_{\text{age}} = 23$  years). Participants were tested individually on a computer and received a payment of 5 RMB (approximately U.S.\$0.80).

**Procedure.** Upon arrival, participants were led to a separate room to complete two ostensibly unrelated tasks. The first procedure involved the concept identification task used in Experiment 1. This was the manipulation of control deprivation. After completing it, they moved on to the 20-trial categorization task, adapted from Norenzayan et al. (2002), which served as the dependent measure.

Participants were presented with a series of presentations, each consisting of a target object beneath two groups or categories of four similar objects (see Figure 4 for an example). Participants were asked to decide which category the target object belonged to. The two categories and the target object for each stimulus set were designed so that participants could make a decision either based on rules or based on family resemblance. That is, participants were given a choice to rely on either a unidimensional rule or a family resemblance. The target shared one feature in common with all members of one group (analytical process), but it shared multiple albeit different features with each member of the other group. Participants mouse-clicked one group to indicate their selection.

The procedure involved one practice item and then 20 stimulus sets, displayed in random sequence. After each response, the computer displayed the next one. Participants were instructed that they could take as long as needed but should not spend too much time on any single item.

## Results and Discussion

The dependent measure was the percentage of rule resemblance solutions for each participant, across the 20 trials. As predicted,

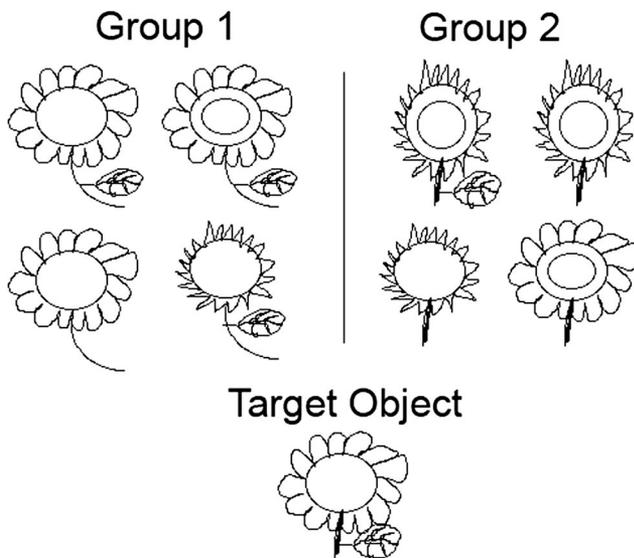


Figure 4. An example of stimuli used in Experiment 3 (Norenzayan et al., 2002). "Which group does the target object belong to?" Target can be classified to a group on the left based on a family resemblance or can be assigned to a group on the right based on a rule.

reliance on strict rules instead of holistic family resemblances was increased by control deprivation,  $F(1, 58) = 4.64, p = .035, \eta_p^2 = .07$ . On average, 71.1% of classification decisions were based on rules in the control-deprivation condition ( $SD = 21.2\%$ ), but only 59.1% of decisions were based on rules in the no-feedback condition ( $SD = 21.8\%$ ). Thus, Chinese participants who underwent an experience of frustrating, noncontingent failure on the concept formation task shifted to exhibit a strong preference for categorizing based on strict general rules, consistent with analytical cognitive approaches.

## Experiment 4

Experiment 4 also used categories to test the shifting preferences between analytical and holistic thinking, but unlike Experiment 3, it used category resemblance as part of logical arguments. Participants were instructed to rate how convincing were various arguments that applied general principles to specific exemplars. The exemplars varied as to how typical they seemed for the category. For example, an eagle is considered a more typical bird than a penguin. If people think in terms of logical rules, then rules about birds should apply equally well to birds and penguins. In contrast, if they favor holistic styles of reasoning, then insofar as penguins are less typical birds than are eagles, general principles about birds may seem less convincing when applied to penguins than when applied to eagles. Applying that principle, Norenzayan et al. (2002) used arguments of the following form: All birds have ulnar arteries; therefore, all eagles have ulnar arteries. Whether that argument is equally convincing when applied to penguins instead of eagles is thus an indication of whether the participant is thinking analytically or holistically. In fact, although the analytical argument is correct and the two forms of the argument are equally valid, many people find the atypical (e.g., penguin) argument less convincing than the argument with the typical exemplar (Slooman, 1993).

Feelings of control were manipulated with the autobiographical recall procedure as in Experiment 2. The prediction was that recalling control deprivation would reduce the tendency to be more convinced by the argument with typical exemplars than the argument with atypical ones.

## Method

Fifty-four Chinese students (27 of each gender) from Sun Yat-Sen University participated for payment. They first completed the same control manipulation used in Experiment 2, namely, writing about a personal experience of having or of lacking control. Next, they read 10 pairs of deductive categorical arguments and rated how convincing these were. Each pair of arguments began with the same premise, a statement about a superordinate category. This premise was then applied to a typical and an atypical exemplar of the category. Each argument was rated on a Likert scale, from 0 (*very weak/unconvincing*) to 10 (*very strong/convincing*).

## Results and Discussion

The ratings for the 10 arguments with typical exemplars were averaged, as were the 10 items with atypical exemplars, creating for each participant two indices, one of how convincing he or she

found the typical arguments and one of how convincing he or she found the atypical exemplar arguments. These were entered into an analysis of variance (ANOVA) with one within-subjects factor (type of exemplar) and one between-subjects factor (control deprivation level). This ANOVA revealed a significant interaction between control deprivation and exemplar type,  $F(1, 52) = 4.944$ ,  $p < .05$ ,  $\eta_p^2 = .09$ . The within-subjects main effect was also significant,  $F(1, 52) = 65.14$ ,  $p < .001$ ,  $\eta_p^2 = .56$ , indicating a general preference for typical ( $M = 7.81$ ,  $SD = 1.99$ ) over atypical arguments ( $M = 5.87$ ,  $SD = 2.17$ ). The between-subjects main effect of control deprivation was not significant,  $F(1, 52) = 2.69$ ,  $p = .11$ ,  $\eta_p^2 = .05$ , thus contradicting any alternative hypothesis that control deprivation simply made all arguments seem convincing.

Consistent with theory and predictions, the interaction was apparently brought about because control deprivation made people more appreciative of the analytically sound but holistically unappealing arguments, which is to say, the ones with atypical exemplars. This fits the general pattern and central hypothesis of this investigation, which is that control deprivation causes Chinese participants to shift toward a more analytical (i.e., Western) style of thinking. Control deprived participants rated these analytically good, holistically bad arguments as more convincing than did high control participants ( $M = 6.54$ ,  $SD = 1.80$  vs.  $M = 5.19$ ,  $SD = 2.31$ ),  $F(1, 52) = 5.766$ ,  $p = .02$ ,  $\eta_p^2 = .10$ . The two groups did not differ in how convincing they found the arguments with typical exemplars to be ( $F < 1$ , *ns*).

Thus, control deprivation again shifted Chinese participants toward using Western-style thinking. These results complement those of Experiment 3 in another important way. In Experiment 3, participants in the high control condition (and thus in all conditions) already favored categorizing by rules, which indicates that the baseline preference on that task was to use Western-style analytical thinking. In Experiment 4, participants in the high control condition (and, based on the main effect, across all conditions) favored arguments with typical exemplars over those with atypical exemplars, which signifies that the baseline preference on this task was for Eastern-style holistic thinking. Taken together, the two studies show that control deprivation shifts Chinese participants toward using more analytical styles of thinking, regardless of which style is initially dominant on the task. The shift is the same, regardless of the starting point.

### Experiments 5A and 5B

Predictions of stability versus change were the focus of Experiment 5. Analytical thinking is based on strong assumptions of stable properties and laws. In contrast, holistic thinking tends to emphasize constant change and fluctuations. Moreover, holistic thinking views changes as invoking opposing trends, so that there is a kind of rhythm in which strong trends are soon counteracted by opposing developments in a kind of dialectical relationship. Analytical thinking, in contrast, tends to assume that forces operate independently of each other, making it appropriate to extrapolate from linear trends. Nisbett et al. (2003) proposed that the difference is linked to the focus on object versus field. Analytical thinkers focus on the single object and its properties, so it seems reasonable to assume that the object will continue to do whatever it is doing. Holistic thinkers focus on the interplay of object and

background, which makes it seem likely that countervailing forces will arise and that future outcomes may therefore be the opposite of current trends.

Experiment 5 presented participants with four scenarios and asked them how likely was a future, contrary outcome. The prediction was that control deprivation would make people more likely to extrapolate in linear fashion from present trends, thereby making opposite outcomes seem less likely. Two versions of the experiment were done, using the two control deprivation manipulations.

### Method 5A

Sixty students (32 female) aged 19–37 years, with a mean age of 23.6 years, took part. They first underwent the control manipulation from Experiment 1, with the concept formation task. After this, they were presented with four simple scenarios and asked to make a prediction. This task was drawn from Ji et al. (2001). These involved predicting how likely it was that a dating couple would break up, how likely it was that two squabbling kindergarten pupils would grow up to become lovers, how likely it was that a poor child who managed to attend college would one day be rich, and how likely it was that a chess champion would lose his next game against a strong opponent. Probability ratings were made on a Likert scale, from 1 (*extremely unlikely*) to 8 (*extremely likely*).

### Results 5A

The four different scenarios yielded similar patterns of results. In each case, the control deprivation means ( $M_s = 4.52, 4.27, 5.03, 3.88$ ) indicated less predicted change than did the no-feedback condition ( $M_s = 4.96, 4.63, 5.56, 4.37$ ),  $F(1, 58) = 4.45$ ,  $p = .039$ ,  $\eta_p^2 = .07$ . Therefore, we averaged responses across the four scenarios to create a single index as the dependent variable. The Cronbach's alpha ( $\alpha = .06$ ) was low, though there was no reason to expect it to be high, insofar as it is constructed from predictions about different things. Given the low alpha, this set of measures should be regarded not as a homogeneous scale but rather as a series of observations to see whether there was any tendency to make nonlinear predictions. Participants in control-deprivation group ( $M = 4.42$ ,  $SD = 0.78$ ) predicted less change than did those in no-feedback group ( $M = 4.88$ ,  $SD = 0.89$ ),  $F(1, 58) = 4.45$ ,  $p = .039$ ,  $\eta_p^2 = .07$ . Thus, participants in control-deprivation condition thought it was less likely for things to change in the future than did those in the no-feedback condition.

### Method 5B

Forty-two students (20 male, 22 female) aged 20–45 years, with a mean age of 23 years, took part. They first completed the recall task used in Experiment 2, writing about a personal experience of either high or low control. Then they rated the same four scenarios used in Experiment 5A.

### Results 5B

As in Experiment 5A, the control deprivation means ( $M_s = 5.00, 3.50, 4.65, 4.05$ ) were combined to form a single index (Cronbach's  $\alpha = .29$ ), as were the no-feedback condition means ( $M_s = 5.00, 5.27, 4.95, 4.45$ ). ANOVA on this index revealed that

recalling control deprivation led to less predicted change ( $M = 4.30$ ,  $SD = 0.83$ ) than recalling a high control experience ( $M = 4.92$ ,  $SD = 1.00$ ),  $F(1, 40) = 4.78$ ,  $p = .035$ ,  $\eta_p^2 = .11$ .

## Discussion

An analytical style of thinking assumes that the world operates on the basis of stable principles, and so future events are likely to be similar to current ones. Predictions can therefore be made by relatively straightforward extrapolation from the present. In contrast, holistic and dialectical styles of thinking see the world as operating on the basis of shifting and conflicting forces, so that future events may be quite different from the present ones.

Experiments 5A and 5b showed that recalling an experience of control deprivation, or having such an experience, caused East Asian participants to shift away from the holistic style of prediction toward the analytical style. More precisely, the control deprivation experience caused them to shift away from predicting future outcomes that were in some respects the opposite of the present ones: a chess champion would lose the next match, a couple in love would break up, a pair of antagonistic children would grow up to become lovers, and a poor student would become rich. Participants who had recalled high control or who had done the concept formation task without feedback were more willing to make such predictions.

## Experiment 6

In Experiment 6, we sought to increase generality by showing that Western participants would also shift toward greater use of analytical thinking styles in response to control deprivation. Control deprivation was manipulated with the autobiographical recall test (as in Experiment 2). Analytical thinking was measured with the categorization task used in Experiment 3. The prediction was that recalling experiences of control deprivation would cause Western participants to categorize by rules more than by holistic resemblance and relationships.

## Method

Fifty-four Western participants (28 female, 26 male; all British, except for two Spanish and one French) participated in the experiment and were randomly assigned to two conditions. All of them were Caucasian students at University of Glasgow, with the mean age of 24 years. They received 3£ (approximately U.S.\$4.80) for their participation.

Participants first completed the recall manipulation as in Experiment 2. Then, participants assigned objects to categories as in Experiment 3.

## Results and Discussion

The dependent measure was the percentage of rule versus resemblance solutions for each participant, across the 20 trials. Reliance on strict rules instead of holistic family resemblances was increased by control deprivation,  $F(1, 53) = 5.53$ ,  $p = .022$ ,  $\eta_p^2 = .10$ . On average, 55.0% of classification decisions were based on rules in the control-deprivation condition ( $SD = 21.6\%$ ), but only 41.3% of decisions were based on rules in the high control condition ( $SD = 21.2\%$ ). Thus, similar to what we found with Chinese

participants, Caucasian participants in the control deprivation condition shifted to exhibit a strong preference for categorizing based on strict general rules, consistent with analytical cognitive approaches. Thus, even though the two cultures may have different baseline tendencies for holistic versus analytical thinking, control deprivation causes members of both cultures to shift toward more reliance on analytical thinking.

## Experiment 7

Thus far, we have shown that control deprivation causes East Asian participants to shift away from their habitual, holistic style of thinking toward a more analytical style. With Experiment 7, we began to investigate why this would occur. Our line of reasoning was that control deprivation stimulates desire for control, and analytical thinking is more useful than holistic thinking for purposes of primary control. In other words, the shift in thinking style is intended to help restore some of the sense of control that was lost. The notion that people shift thinking styles in order to gain control has been supported in other contexts. For example, Reuven-Magril, Dar, and Liberman (2008) found that people with obsessive-compulsive tendencies gained a higher sense of control than did normal people, by using repetitive responses in a pattern-finding task.

The hypothesis for Experiments 7 and 8 was that analytical cognition would in fact increase sense of control. In both studies, we manipulated control deprivation and then administered a cognitive task, just as in Experiments 1–5. The difference was that in these two studies, we manipulated the instructions for how to perform the cognitive task. The task in Experiment 7 was a visual focusing task, similar to what we used in Experiment 1. Half the participants were instructed to focus attention on (and evaluate) the prominent object in the foreground. The others were told to focus on the background. Our prediction was that focusing on the object would increase the sense of control, relative to focusing on the background. Thus, focusing on the object would help restore some of the sense of control that was reduced by the control deprivation experience.

## Method

One hundred and seventy-two Chinese students (95 male, 77 female) participated for 10 RMB (approximately U.S.\$1.60). They first completed the concept identification task used in Experiment 1, which manipulated the experience of control deprivation. Then all were asked to evaluate a series of pictures. Half were instructed to evaluate the main object in the center of each picture and ignore the background. The rest were instructed to evaluate the backgrounds and ignore the foregrounded objects.

Following this, all participants completed a questionnaire measure of sense of control. The measure was taken from Michinov (2005) and contained 12 items referring to personal mastery or perceived constraints. A sample item was "When I want to do something, I usually find a way to succeed at it." Responses to each item were indicated on a scale running from 1 (*I strongly disagree*) to 5 (*I strongly agree*).

## Results and Discussion

Responses to the 12 items on the personal control scale were summed to create the dependent measure. ANOVA on those

scores revealed two main effects. Sense of control was lower among participants who had experienced control deprivation than among those who had not ( $M = 3.10, SD = 0.89$  vs.  $M = 3.73, SD = 0.56$ ),  $F(1, 168) = 33.45, p < .001, \eta_p^2 = .17$ . That finding can be considered a manipulation check, and it indicates that the manipulation was successful in altering subjective levels of control.

More important, the main effect for attentional focus was significant,  $F(1, 168) = 16.46, p < .001, \eta_p^2 = .09$ . (Consistent with predictions, the interaction was not significant,  $F < 1, ns$ .) Participants who attended to the foreground object reported a higher sense of personal control than participants who evaluated the backgrounds ( $M = 3.64, SD = 0.63$  vs.  $M = 3.19, SD = 0.90$ ). Of particular relevance to the hypothesis, the sense of control among participants who had undergone control deprivation was higher after focusing on foreground objects than after focusing on backgrounds ( $M = 3.36, SD = 0.53$  vs.  $M = 2.84, SD = 1.09$ ),  $F(1, 168) = 11.20, p = .001, \eta_p^2 = .07$ . Indeed, as can be seen from Figure 5, focusing on objects almost precisely offset the impact of control deprivation: The levels of feeling personal control in the control deprivation–focus on foreground object condition and the no deprivation–focus on background condition were quite similar.

### Experiment 8

Experiment 8 was a conceptual replication of Experiment 7, with different methods. It sought to show that categorizing items by strict abstract rules, as is favored in analytical thinking, would offset the loss of sense of control caused by recalling a personal experience of lacking control.

### Method

One hundred and eighty Chinese students (100 male, 80 female) participated for 10 RMB (approximately U.S.\$1.60). Their average age was 20 years. First, they performed the autobiographical recall

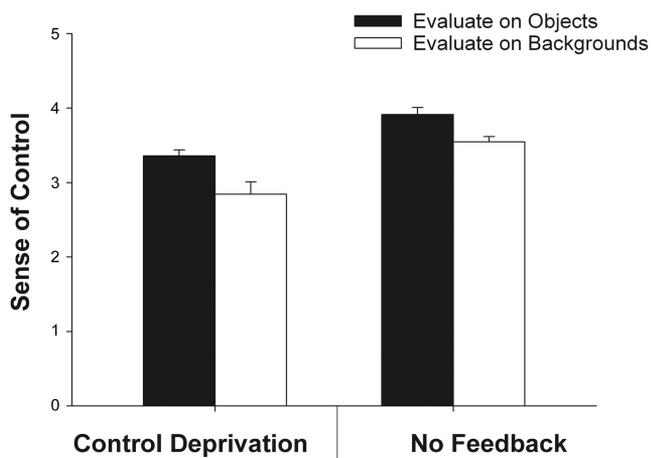


Figure 5. Compared with those evaluating on backgrounds, focusing attention on objects make participants report more sense of control in both the no-feedback conditions (baseline groups) and control deprivation conditions (experimental groups).

manipulation of control, as in Experiment 2. Half described a personal experience of lacking control, while the rest described an experience of having full control.

Then, they were instructed to classify 16 groups of objects. Each group consisted of three objects, such as airplane, train, and rail, that could be classified either by abstract rules (airplane and train are both means of transport) or by functional affinity and family resemblance (train and rail go together). Half the participants were instructed to classify objects based on rule-based category membership, and the rest were instructed to classify based on functional relationships and family resemblances. These procedures were adapted from Chiu (1972) and Norenzayan et al. (2002).

Last, participants completed the questionnaire measure of personal control used in Experiment 7. This was the dependent measure.

### Results and Discussion

ANOVA on self-reported feelings of control revealed two main effects. The interaction was not significant ( $F < 1, ns$ ). Participants who recalled experiences of lacking control reported lower feelings of control in the present than did participants who recalled experiences of having full control ( $M = 3.01, SD = 0.75$  vs.  $M = 3.63, SD = 0.54$ ),  $F(1, 176) = 43.31, p < .001, \eta_p^2 = .25$ . That finding confirms that the manipulation was effective at altering current sense of control.

The hypothesis was tested by the main effect of categorizing style. Overall, participants who categorized with abstract rules ended up with higher feelings of personal control than participants who categorized using holistic bases such as relationships ( $M = 3.49, SD = 0.58$  vs.  $M = 3.14, SD = 0.80$ ),  $F(1, 176) = 14.40, p < .001, \eta_p^2 = .08$ . The corresponding difference in the control deprivation condition was most relevant to the hypothesis. Participants who recalled control deprivation and then categorized based on rules had higher feelings of control than those who recalled the same type of experience but then classified based on relationships ( $M = 3.23, SD = 0.75$  vs.  $M = 2.79, SD = 0.90$ ),  $F(1, 176) = 11.15, p = .001, \eta_p^2 = .06$ .

It could be objected that one task may have been more difficult than the other and that the differential task difficulty contributed to the differences in subjective control. To explore this possibility, we conducted a pilot study by asking 80 participants (with similar characteristics as in Experiment 8) to categorize 16 groups of objects either analytically or holistically. Participants performed this task on the computer in E-prime (Version 1.20). We recorded their reaction time (RT) and accuracy (ACC) scores. We log-transformed the RT data as suggested by Ratcliff (1993). In order to control for any presence of a speed–accuracy trade-off, we then computed a composite score by dividing transformed RT by ACC scores (e.g., Kiss, Driver, & Eimer, 2009; Townsend & Ashby, 1983). We performed a one-way ANOVA with the between-factor of group on this composite score,  $F(1, 78) < 1, ns$ . There was thus no difference in performance quality (speed and accuracy combined) between the analytical categorization and the holistic categorization task, suggesting that they were about equally difficult. This finding should allay concerns that the manipulation was confounded with task difficulty.

## Experiment 9

Experiment 9 was added to address alternative explanations. We sought to replicate the finding that analytical thinking increased sense of control relative to holistic thinking. We also sought to rule out the possibility that the analytical thinking task was easier than the holistic thinking task. It could be objected that the task used in the holistic condition of Experiment 7 was difficult because all participants looked at the focal objects for a significant part of the time. For Experiment 9, we changed to a different task (asking participants to explain why two things went together, thus explicitly having to use either analytical or holistic thinking), and we also obtained difficulty ratings for each step of the task.

### Method

Eighty Chinese students (21 male, 59 female) participated for 10 RMB (approximately U.S.\$1.60). Their average age was 19 years. They were presented with 16 pairs of objects and instructed to explain why the two belonged together. In the analytical thinking condition, the pairs belonged to the same abstract categories (e.g., cow, chicken; train, airplane). In the holistic thinking condition, the pairs involved objects that had active or functional relationships (e.g., cow, grass; train, rail). After explaining why each pair of objects went together, participants rated on a 7-point scale how difficult it was to give a reason. After completing all 16 pairs, participants then completed the measure of perceived sense of personal control, as in Experiments 7 and 8.

### Results and Discussion

The two tasks appear to have been about equally difficult. The ratings for the 16 items were averaged for each participant to furnish an overall difficulty measure. These were nearly identical in the analytical condition ( $M = 2.09$ ,  $SD = 0.25$ ), as in the holistic thinking condition ( $M = 2.07$ ,  $SD = 0.30$ ), and the difference did not approach significance,  $F(1, 77) = 0.14$ , *ns*. We then ran a separate ANOVA for each item, and as probability theory would predict regarding purely chance variation, only one of the 16 approached significance at the .05 level:  $F(1, 78) = 3.44$ ,  $p = .07$ ,  $\eta_p^2 = .04$ .

Responses to the sense of control questionnaire were averaged to furnish a composite rating. The scale was reasonably coherent (Cronbach's  $\alpha = .78$ ). Participants in the analytical thinking condition ( $M = 3.51$ ,  $SD = 0.56$ ) had a higher sense of control than did those in the holistic thinking condition ( $M = 3.22$ ,  $SD = 0.54$ ),  $F(1, 78) = 5.54$ ,  $p = .02$ ,  $\eta_p^2 = .07$ . Also as predicted, sense of control was unrelated to perceived task difficulty ( $r = .09$ , *ns*).

Thus, Experiment 9 provided further evidence that engaging in analytical thinking causes an increase in sense of perceived control. This increase was not due to the differential difficulty of the task or of the style of thinking.

## Experiment 10

The last three experiments were concerned with the effects of different degrees of control deprivation. Prior work established that people respond differently to brief versus prolonged experiences of lacking control: Brief experiences motivate people to try harder to reassert control, whereas prolonged experiences cause

people to give up and become passive or helpless (e.g., Roth & Kubal, 1975; Wortman & Brehm, 1975).

We have reasoned that control deprivation motivates East Asians to switch to thinking in the Western analytical style because control deprivation stimulates desire for control, and analytical thinking seems a promising way to gain control. If that is correct, then the effect may be reversed by prolonged experiences of controlled deprivation because the effect on desire for control may reverse. Hence, Experiment 10 used the control deprivation manipulation from Experiment 1 but added a condition that tripled the duration of the experience. We then used a visual tracking procedure to measure how participants allocated their gaze between the foreground object and the background. We predicted that Asian participants would tend to focus on the background in the no-feedback control condition and that they would shift attention toward the foreground object after brief control deprivation—but that they would focus on the background after prolonged control deprivation.

### Method

Eighty-four Chinese students (55 female, 29 male) with mean age of 22 years took part. All had normal vision with or without glasses. The procedure was identical to Experiment 1, except with the addition of a long version of the concept identification task. Whereas participants in the short control deprivation condition performed four blocks of 10 trials, each on the concept identification task, as in Experiment 1, the long control deprivation condition consisted of 12 blocks of 10 trials. There were also both short and long versions of the no-feedback condition on the control deprivation task. Following this manipulation of control, all participants completed the visual tracking task, as in Experiment 1.

### Results and Discussion

For each dependent variable, we conducted a  $2 \times 2$  ANOVA. The interaction between duration (short vs. long) and control (no feedback vs. control deprivation) was significant for onset time to first look at foreground object,  $F(1, 80) = 14.71$ ,  $p < .001$ ,  $\eta_p^2 = .16$ , for dwell time looking at foreground object,  $F(1, 80) = 8.42$ ,  $p = .005$ ,  $\eta_p^2 = .10$ , for dwell time on background,  $F(1, 80) = 9.95$ ,  $p = .002$ ,  $\eta_p^2 = .11$ , and for number of fixations on foreground objects,  $F(1, 80) = 12.14$ ,  $p = .001$ ,  $\eta_p^2 = .13$ . The main effects of control deprivation were not significant ( $F_s < 1$ , *ns*), presumably because the different effects of short versus long control deprivation offset each other. The main effects of duration were significant,  $F(1, 80) = 9.74$ ,  $p < .005$ ,  $\eta_p^2 = .11$ , for onset time;  $F(1, 80) = 9.98$ ,  $p < .005$ ,  $\eta_p^2 = .11$ , for dwell time on objects; and  $F(1, 80) = 12.19$ ,  $p = .001$ ,  $\eta_p^2 = .13$ , for fixation counts on foreground objects.

The two no-feedback conditions did not differ from each other on any measure ( $F_s < 1$ , *ns*). Thus, the duration of the concept identification task did not have any discernible effects on performance during the visual tracking task. The interactions were thus apparently driven by the differences between the two control deprivation conditions. We compared results from those conditions with their respective baselines from the no-feedback condition.

Results from the short control deprivation task replicated the findings with Chinese participants in Experiment 1. That is, the

short control deprivation experience caused participants to shift attention faster to the foreground objects in the pictures ( $M = 422$  ms,  $SD = 55$  ms vs.  $M = 496$  ms,  $SD = 142$  ms),  $F(1, 80) = 5.30$ ,  $p < .05$ ,  $\eta_p^2 = .07$ , to dwell longer on the foreground objects ( $M = 1,185$  ms,  $SD = 152$  ms vs.  $M = 1,060$  ms,  $SD = 207$  ms),  $F(1, 80) = 5.37$ ,  $p < .05$ ,  $\eta_p^2 = .07$ , to spend less time looking at the background ( $M = 1,094$  ms,  $SD = 160$  ms vs.  $M = 1,263$  ms,  $SD = 192$  ms),  $F(1, 80) = 7.26$ ,  $p < .01$ ,  $\eta_p^2 = .09$ , and to look more frequently at the foreground objects ( $M = 4.95$ ,  $SD = 0.70$  vs.  $M = 4.48$ ,  $SD = 0.89$ ),  $F(1, 80) = 4.33$ ,  $p < .05$ ,  $\eta_p^2 = .05$ , as compared with participants who performed the short version of the concept identification task. Thus, brief control deprivation made Chinese participants look like Westerners in the sense that they allocated more attention to the foreground object in each picture than to the background.

In contrast, participants who underwent the long control deprivation shifted in the opposite direction. After the long experience of control deprivation, participants were slower to look at the foreground objects ( $M = 579$  ms,  $SD = 106$  ms vs.  $M = 480$  ms,  $SD = 88$  ms),  $F(1, 80) = 9.75$ ,  $p = .003$ ,  $\eta_p^2 = .12$ , spent marginally less time looking at objects ( $M = 953$  ms,  $SD = 200$  ms vs.  $M = 1,050$  ms,  $SD = 129$  ms),  $F(1, 80) = 3.19$ ,  $p = .08$ ,  $\eta_p^2 = .04$ , spent marginally more time looking at backgrounds ( $M = 1,330$  ms,  $SD = 195$  ms vs.  $M = 1,237$  ms,  $SD = 126$  ms),  $F(1, 80) = 3.12$ ,  $p = .08$ ,  $\eta_p^2 = .04$ , and looked fewer times at the foreground objects ( $M = 3.83$ ,  $SD = 0.73$  vs.  $M = 4.47$ ,  $SD = 0.58$ ),  $F(1, 80) = 8.10$ ,  $p = .006$ ,  $\eta_p^2 = .10$ , as compared with participants who did the long version of the no-feedback condition. Thus, in a sense the Chinese participants shifted toward a more extremely Asian nonanalytical style of perception as a result of having a prolonged experience of control deprivation.

### Experiment 11

Experiment 11 used the same design as Experiment 10, except with a different dependent measure. Experiment 11 measured whether people categorized objects based on abstract rules or on relationships and family resemblance. The prediction was that brief control deprivation would cause Asians to shift toward categorizing more on the basis of abstract rules, but prolonged control deprivation would reverse that effect.

### Method

One hundred Chinese students (72 female), with mean age of 19 years, took part. The design and procedure were identical to those of Experiment 10, except that the final task (measuring the dependent variable) was changed. In this experiment, after the concept identification task was done to manipulate short and long control deprivation, all participants performed a classification task. It was adapted from Chiu (1972) and Norenzayan et al. (2002). Participants were given 16 groups of three objects each. One of them could be grouped with either of the others, depending on whether the participant grouped by abstract rules or by relationships and family resemblance. The measure was how many of the 16 classifications conformed to the abstract rule rather than the relationship or resemblance. For this composite measure, Cronbach's alpha was .72.

## Results and Discussion

We conducted a  $2 \times 2$  ANOVA on the tally of responses that indicated classifying based on abstract rules. It revealed a significant interaction between duration (short vs. long) and control (deprivation versus no feedback),  $F(1, 96) = 9.77$ ,  $p = .002$ ,  $\eta_p^2 = .09$ . The main effect of control deprivation was not significant ( $F < 1$ , *ns*).

The main effect of duration of the concept identification task was significant ( $M_{\text{short}} = 5.60$ ,  $SD = 3.28$  vs.  $M_{\text{long}} = 4.34$ ,  $SD = 2.61$ ),  $F(1, 96) = 4.90$ ,  $p < .05$ ,  $\eta_p^2 = .05$ . However, the interaction qualifies the meaning of this. The two no-feedback conditions did not differ ( $F < 1$ , *ns*), which suggests that the duration of the concept identification task did not by itself have any effect. Hence, the significance of the main effect and interaction were presumably due to what happened in the two control deprivation conditions.

The most important and novel finding was that the long control deprivation condition ( $M = 3.32$ ,  $SD = 2.16$ ) was significantly more likely than the long no-feedback condition ( $M = 5.36$ ,  $SD = 2.66$ ) to elicit classifications based on relationships and resemblances,  $F(1, 96) = 6.42$ ,  $p = .013$ ,  $\eta_p^2 = .07$ . Meanwhile, participants in the short control deprivation condition ( $M = 6.36$ ,  $SD = 2.91$ ) were less likely than those in the short no-feedback condition ( $M = 4.84$ ,  $SD = 3.50$ ) to classify holistically,  $F(1, 96) = 3.56$ . That difference yields a one-tailed  $p < .05$  and two-tailed  $p = .062$ ,  $\eta_p^2 = .04$ . (One-tailed probabilities may be appropriate given that this finding is a replication of Experiment 2 and conceptual replication of Experiments 1–5 and 10.) The two control deprivation conditions differed from each other,  $F(1, 96) = 14.25$ ,  $p < .001$ ,  $\eta_p^2 = .15$ , with long control deprivation making people more likely to classify holistically ( $M = 3.32$ ,  $SD = 2.16$ ) than short control deprivation ( $M = 6.36$ ,  $SD = 2.91$ ).

Thus, Experiments 10 and 11 both showed that prolonged control deprivation reverses the effect of brief control deprivation. In both cases, brief deprivation caused Chinese participants to approach the next task with analytical thinking—but prolonged control deprivation produced the opposite effect. After prolonged control deprivation, participants responded more holistically than even those in the no-feedback condition. In other words, the prolonged control deprivation not only canceled out the effect of brief control deprivation but produced a significant effect in the opposite direction.

### Experiment 12

In Experiment 12, we sought to replicate the contrary effects of brief versus prolonged control deprivation on thinking styles, with the addition of a self-report measure of desire for control. Based on prior work, we have assumed that brief experiences of control deprivation will increase desire for control—but prolonged experiences of control deprivation will produce the opposite effect, of giving up striving for control (Roth & Kubal, 1975; Wortman & Brehm, 1975). It was however desirable to provide some direct evidence for this. A second goal in Experiment 12 was to show that the changes in thinking styles would be mediated by changes in desire for control.

## Method

One hundred and four Chinese students (58 female, 46 male) with mean age 21.72 years took part. They were randomly assigned to one of four conditions: long control deprivation, short control deprivation, long no-feedback control condition, and short no-feedback control condition. Two participants in the long control deprivation group dropped out before finishing the first task, making the final number for analyzing 102.

First, participants in two short conditions completed four blocks of the concept identification task, whereas participants in two long conditions completed 12 blocks of the concept identification task. Participants in the control deprivation condition completed trials with random feedback, and participants in the no-feedback control condition did not receive feedback.

Following this manipulation of control, all participants completed a simple arithmetic task as a distractor task. Then in a seemingly unrelated task, participants completed a questionnaire with six items measuring the desire for control (sample items were "I don't like situations that are uncertain" and "When it comes to orders, I would rather give them than receive them"). These items were selected from the Personal Need for Structure Scale (Neuberg & Newsom, 1993) and Desirability of Control Scale (Burger & Cooper, 1979) in a pilot study. After that, participants were presented with four simple scenarios and asked to make a prediction about each on a scale from 1 (*extremely unlikely*) to 8 (*extremely likely*), as in Experiment 5.

## Results

**Desire for control.** The six items of control desire were averaged to form a composite score (Cronbach's  $\alpha = .77$ ). A two-way ANOVA with control deprivation/no-feedback control condition and short/long as two independent variables revealed a significant main effect of length of task ( $M_{\text{short}} = 4.75$ ,  $SD = 1.09$  vs.  $M_{\text{long}} = 4.26$ ,  $SD = 1.08$ ),  $F(1, 98) = 6.13$ ,  $p = .015$ ,  $\eta_p^2 = .06$ . The main effect of control deprivation was not significant,  $F(1, 98) = .02$ ,  $p = .89$ . Most important, the interaction effect was significant,  $F(1, 98) = 9.87$ ,  $p = .002$ ,  $\eta_p^2 = .09$ .

Simple effects analysis indicated that short control deprivation increased participants' desire for control ( $M = 5.07$ ,  $SD = 1.28$ ), as compared with the no-feedback condition ( $M = 4.42$ ,  $SD = 0.75$ ),  $F(1, 98) = 5.47$ ,  $p = .021$ ,  $\eta_p^2 = .06$ . Meanwhile, long control deprivation ( $M = 3.94$ ,  $SD = 1.14$ ) decreased participants' desire for control, compared with the no-feedback condition ( $M = 4.55$ ,  $SD = 0.80$ ),  $F(1, 98) = 4.44$ ,  $p = .038$ ,  $\eta_p^2 = .05$ .

**Change predictions.** The four items of change prediction were averaged to form a composite score (Cronbach's  $\alpha = .78$ ). Low scores reflect more analytical thinking (continuation of trend), whereas high scores suggest holistic thinking (reversal of trends). A  $2 \times 2$  ANOVA on predictions, with control deprivation/no-feedback control and short/long as two independent variables, produced results similar to what we found with the desire for control. It revealed a significant main effect of task duration ( $M_{\text{short}} = 4.41$ ,  $SD = 1.56$  vs.  $M_{\text{long}} = 5.22$ ,  $SD = 1.95$ ),  $F(1, 98) = 6.04$ ,  $p = .016$ ,  $\eta_p^2 = .06$ . The main effect of control deprivation was not significant,  $F(1, 98) = 0.10$ ,  $p = .75$ . Again, and most important, the interaction effect was significant,  $F(1, 98) = 9.71$ ,  $p = .002$ ,  $\eta_p^2 = .09$ .

Simple effects analysis confirmed that the brief control deprivation ( $M = 3.94$ ,  $SD = 1.73$ ) reduced change prediction (holistic thinking), as compared with the brief no-feedback condition ( $M = 4.89$ ,  $SD = 1.22$ ),  $F(1, 98) = 4.02$ ,  $p = .048$ ,  $\eta_p^2 = .04$ . In contrast, the long control deprivation ( $M = 5.81$ ,  $SD = 1.89$ ) increased change prediction, as compared with the long no-feedback control condition ( $M = 4.66$ ,  $SD = 1.86$ ),  $F(1, 98) = 5.74$ ,  $p = .018$ ,  $\eta_p^2 = .06$ .

**Mediational analysis in the short control-deprivation condition.** We conducted a series of analyses to test the hypothesis that changes in desire for control mediated the shifts between analytical and holistic thinking styles. In the short control-deprivation condition, control desire predicted thinking style ( $\beta = -.45$ ,  $t = -3.51$ ,  $p = .001$ ), and control deprivation predicted thinking style ( $\beta = -.31$ ,  $t = -2.27$ ,  $p = .028$ ). When we added control desire as another predictor, control deprivation was no longer a significant predictor ( $\beta = -.18$ ,  $t = -1.42$ ,  $p = .16$ ), whereas control desire remained a significant predictor ( $\beta = -.39$ ,  $t = -2.95$ ,  $p = .005$ ). Bootstrapping the mediational effect of control using the method of Preacher and Hayes (2008) yielded a 95% confidence interval (CI; bias-corrected and accelerated) not containing 0, CI [-1.00, -.03]. This pattern of findings confirms that desire for control mediated the effect of control deprivation on thinking style.

**Mediational analysis in the long control-deprivation condition.** In the long control-deprivation condition, desire for control predicted thinking style ( $\beta = -.79$ ,  $t = -9.20$ ,  $p < .001$ ), and the manipulation of control deprivation also predicted thinking style ( $\beta = .30$ ,  $t = 2.16$ ,  $p = .035$ ). When we added control desire as another predictor, control deprivation was no longer a significant predictor ( $\beta = .06$ ,  $t = 0.69$ ,  $p = .50$ ), whereas control desire remained a significant predictor ( $\beta = -.78$ ,  $t = 8.54$ ,  $p < .001$ ). Bootstrapping the mediational effect of control desire using the method of Preacher and Hayes (2008) yielded a 95% CI (bias-corrected and accelerated) not containing 0 [0.14, 1.79]. Thus, again, desire for control manipulated the effect of the experimental manipulation of control deprivation on thinking style.

**The mediated moderation analysis.** To test the mediated moderation, we followed the procedure recommended by Muller, Judd, and Yzerbyt (2005). First, when the independent variable (control deprivation/no feedback), the moderator (long/short), and the interaction term were regressed on the mediator (control desire), the interaction term was a significant predictor ( $\beta = .49$ ,  $t = 3.14$ ,  $p = .002$ ). Second, when the independent variable, the moderator, and the interaction term were regressed on the dependent variable (change prediction), the interaction term was also a significant predictor ( $\beta = .50$ ,  $t = 3.12$ ,  $p = .002$ ). Third, when we added mediator (control desire) as well as the interaction term of the mediator and the moderator into the regression equation to predict change prediction, the effect of the mediator was significant ( $\beta = .33$ ,  $t = 3.17$ ,  $p = .002$ ), and so was the effect of the interaction between the mediator and the moderator ( $\beta = .38$ ,  $t = 3.64$ ,  $p = .001$ ). But the effect of the interaction term between the independent variable and the moderator was no longer significant ( $\beta = .19$ ,  $t = 1.52$ ,  $p = .13$ ). These results supported a significant mediated moderation.

## Discussion

Experiment 12 added two crucial points (in addition to replicating previous findings). First, it showed that desire for control changed in the ways we have assumed. That is, brief experiences of control deprivation caused an increase in the desire for control, but prolonged experiences had the opposite effect of reducing the striving for control. These are consistent with previous work (e.g., Roth & Kubal, 1975), but it is helpful to confirm those patterns in the context of the present work.

Second, the changes in desire for control mediated the changes in thinking style. The brief experiences of control deprivation stimulated people to desire control more strongly, and that increase apparently contributed to their shift toward more analytical thinking styles (in this case, taking the form of making straightforward predictions based on extrapolating from linear trends and expecting them to continue). Meanwhile, the prolonged experiences of control deprivation caused people to give up some of their desire for control, and this decrease apparently contributed to their adopting a very holistic style of thinking, in the form of predicting that future outcomes will be the opposite of present trends.

## General Discussion

The main finding from the present work was that the cultural style of thinking associated with East Asian cultures was shown to be amenable to change based on issues of control. Agentic control has been shown to be among the most important differences among cultures (e.g., Kashima et al., 1995). Our findings supported and replicated previous work in showing that under normal or neutral conditions, Chinese think in a holistic style that is different from the analytical style favored in Western culture. Our more novel contribution was that a brief experience of control deprivation caused Chinese participants to shift toward more analytical styles of thinking. Our work adds to a growing body of evidence indicating that cultural differences in cognition are not simply immutable outcomes of cultural programming but rather indicate flexible tendencies that depend on circumstances and motivations (e.g., C.-Y. Chiu et al., 2000; Oyserman & Lee, 2008). Illuminating those circumstances and motivations can shed light on the very functions of thinking. More broadly, our findings fit the emerging view that the human mind is inherently designed to develop in interaction with culture, so that culture and the human mind are mutually interdependent and mutually constructive (Kashima, 2000). Instead of seeing people as innately disposed to think in certain ways, the view of humans as cultural animals (Baumeister, 2005) emphasizes that people are innately disposed to learn how to think from their culture. Hence as circumstances and motivations change, thinking styles may also change, even for people embedded within a culture.

Our first study compared the responses of East Asian (Chinese) and Western (Caucasian) participants. Control deprivation was manipulated by giving random feedback on a concept formation task, so that people's efforts to discern a pattern in stimuli would be frustrated despite getting some positive feedback (mixed with negative). Without such frustrating feedback, Chinese participants showed the holistic pattern of dividing attention between foreground and background, whereas Westerners focused mainly on the foreground object. But after control deprivation, the Chinese

participants shifted to focus more on the foreground, thus coming to allocate their attention in the culturally Western pattern. Westerners showed some changes toward increasing their focus on the foreground, thus in a sense becoming more extreme exemplars of Western-style, analytical cognition. The difference between Chinese participants and Westerners was no longer significant following control deprivation.

The next set of experiments was designed to show multiple changes in cognitions among Chinese participants, all reflecting the general pattern in which control deprivation caused an increase in Western-style, analytical thinking. Control deprivation made Chinese shift toward favoring logical arguments rather than dialectical ones (Experiment 2). It made them categorize more by rules than by family resemblances and affinities (Experiment 3). It made them more open to and more convinced by arguments that were logically sound but employed atypical (and therefore less intuitively appealing) exemplars (Experiment 4). It made them predict the future more by linear extrapolation extending current trends rather than by expecting reversals toward holistically balanced opposites (Experiment 5).

Western participants responded to control deprivation in a similar manner as Chinese ones, as Experiment 6 showed. Although the baseline level of analytical thinking is higher in Western than East Asian culture, control deprivation apparently causes both groups to shift toward (even) greater reliance on analytical thinking. Our investigation thus confirms both cultural differences and cross-cultural similarities in cognition. In both cultures, apparently, when people want control over their environment, they turn to analytical styles of cognition.

Following that, we turned to the question of why control deprivation would cause East Asians to change their style of thinking. Control deprivation is generally understood as stimulating the motivation to regain control—so the cognitive shifts might reflect efforts to increase one's sense of control. Consistent with that prediction, we showed that Chinese participants' sense of personal control was indeed increased by thinking in an analytical manner. This was found with adopting the Western perceptual style (focusing attention on the foreground objects; Experiment 7), with adopting the Western thinking style (categorizing based on rules instead of relationships; Experiment 8), and with adopting the Western style of linear prediction (continuing rather than reversing current trends; Experiment 9). These manipulations increased sense of control both among control-deprived and nondeprived participants.

Thus, control deprivation caused Chinese participants to shift toward employing analytical styles of cognition, which in turn helped restore their sense of control. These results fit the view that cognitive styles are motivated in part by control needs. But the effect of control deprivation on efforts to restore control are nonlinear, as past work has shown (e.g., Roth & Kubal, 1975). Brief experiences of control deprivation motivate people to seek control, but prolonged experiences engender a state that seemingly resembles learned helplessness, insofar as the person eventually abandons efforts to regain control. Our theory about motivated cognition therefore had to predict that an extended experience of control deprivation would alter thinking styles in different ways, potentially reversing the effects of brief control deprivation.

Therefore, the final three experiments compared short and long deprivations of control. Consistent with the earlier findings, brief

experiences of not having control led to an increase in analytical thinking. But consistent with the motivational theory, prolonged experiences of not having control reversed that effect, causing Chinese participants to shift back to favoring holistic styles of cognition. This too was found with both perceptual style (focusing on background vs. foreground; Experiment 10) and categorization (by rules vs. relationships; Experiments 11–12). The implication is that when control deprivation goes past the point of stimulating the quest for personal control, it ceases to motivate East Asian persons to adopt the Western, analytical thinking styles. In fact, we found that prolonged control deprivation caused the Chinese participants to become even more holistic in their thinking than the baseline (no feedback) conditions.

Furthermore, and crucially, Experiment 12 established that changes in the desire for control mediated both effects. Increased desire for control mediated the shift to analytical thinking after brief deprivation of control, and decreased desire for control mediated the shift toward holistic thinking after prolonged deprivation of control.

Does having control promote holistic thinking? Our procedures did not permit comparison between high control and no-feedback conditions, as we used either high control or no feedback to compare the effects of control deprivation. Although comparison across experiments is inherently hazardous, it is perhaps noteworthy that Experiments 5A and 5B used the same dependent measure with the different comparison groups, and they yielded almost identical means (4.88 and 4.92). Thus, there is no sign that experiencing high control causes people to shift toward a preference for holistic thinking. Instead, we found the elevated preference for holistic thinking among people who were severely deprived of control (Experiments 10–12). One might therefore cautiously speculate that the characteristically East Asian style of holistic thinking is more likely a product of a cultural history in which individuals have been severely deprived of control than one in which they experienced a high degree of control.

Our findings appear to be quite robust. Converging results were found with two different manipulations of control deprivation, one of which used a current and laboratory-induced experience and one of which relied on having people recall and relive actual experiences from their lives. Likewise, we found converging results with four different measures of analytical versus holistic thinking: attending to foreground versus background, favoring logical-deductive versus dialectical reasoning, categorizing by abstract rules versus relationships and resemblances, and predicting the future by extrapolating linear trends to continue from the present versus expecting trends to reverse themselves. We also found no link to self-reported emotional states.

The broader implication of our findings is that cultural differences in thinking styles may be linked to attitudes toward personal control, and East Asians, at least, are quite capable of changing away from their culturally predominant way of thinking. The analytical style of thought favored by Westerners appears to be associated with facilitating individual control. Both Westerners and Chinese used that style when they had been briefly deprived of control and presumably were motivated to regain control. Moreover, when we instructed Chinese people to use that style of cognition, they reported an increased sense of control.

In contrast, shifts toward the East Asian style of cognition were found when control deprivation was prolonged. This could reflect

a motivational shift, as suggested by learned helplessness theory, which proposes that animals and people eventually abandon efforts to gain control (Seligman, 1975). However, it is possible to regard the effects of prolonged deprivation in a different light. Rothbaum et al. (1982) proposed that when primary control (changing the world to suit the self) fails, people shift toward secondary control (changing the self to fit the world). The return to holistic thinking after prolonged deprivation of control may thus be considered not an abandonment of desire for control altogether but a shift to a new strategy pursuing a different form of control, by which the self accommodates to an overbearing and inflexible environment. In other words, control deprivation initially motivates East Asians to seek primary control by adopting analytical thinking styles, but if control deprivation continues, East Asians shift back to holistic thinking, which may be more compatible with secondary control.

Although historical and sociological analyses are beyond the scope of this investigation, it is difficult to resist noting the implication that the East Asian holistic style of cognition seems well suited for societal conditions that do not allow individuals wide scope for exerting primary control in the sense of personal opportunity, choice, and advancement. East Asian cultures are widely regarded as collectivistic (e.g., Triandis, 1989), which means that the individual is embedded in the group, and individual desires must submit to the greater good of the larger social context. The need to attune oneself to the broader context may be conducive to holistic thinking. Both in prevailing cultural mythology and in practice, East Asian cultures have not embraced notions of individual undertakings to the extent that Western cultures have. The history of needing to submit to the group may have shaped the cultural styles. The present results indicate, however, that these tendencies may not be written in stone (or into indelible brain structures). However much habit and tradition may incline East Asians to think in holistic terms, a brief laboratory experience designed to stimulate the desire for personal control was sufficient to change them and cause Chinese participants to adopt the analytical styles of perception and cognition that are better suited toward facilitating individual control. The present results thus replicate and affirm the reality of cultural differences while also suggesting the common humanity underneath them.

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