CREATIVITY RESEARCH JOURNAL, *21*(2–3), 139–151, 2009

ISSN: 1040-0419 print/1532-6934 online
DOI: 10.1080/10400410902858683

Problem Finding and Contradiction: Examining the Relationship between Naive Dialectical Thinking, Ethnicity, and Creativity

Susannah B. F. Paletz and Kaiping Peng
University of California, Berkeley

This research examined the association between naive dialectical thinking and creativity, measured as originality in problem construction and reframing (types of problem finding). Ethnic identity (Caucasian vs. Asian/Asian American) was examined as a moderator. Two correlational studies and one experimental study revealed a complex pattern of results: For problems with low inherent contradiction, naive dialectical thinking decreased originality on problem finding tasks, whereas for tasks with higher contradiction, there was no or even a slight positive effect. Furthermore, these relationships were found for Caucasian participants but not for Asian or Asian American participants. This research built upon the long-standing notion that dialectical thinking is positively associated with creativity, but suggests the relationship might be culture-, task-, and process-specific. The nature of dialectical thinking as involving the acceptance of contradiction or necessitating the resolution of tension should be explored.

Despite decades of research, the creative process is still somewhat a mystery. Progress has been made in distinguishing different cognitive processes used in creativity, such as incubation, combination, and problem construction (e.g., Finke, Ward, & Smith, 1992; Ward, Smith, & Finke, 1999; Ward, Smith, & Vaid, 1997). Although it has been theorized that dialectical thinking as a cognitive style would lead to greater creativity (e.g., Benack, Basseches, & Swan, 1989), this connection has rarely been tested directly. This article presents three laboratory studies that seek to determine the relationship between dialectical thinking as an implicit attitude/cognitive style and one particular creative process, namely problem finding. Because other cognitive processes, such as attribution, covariation detection, categorization, judgment heuristics, and syllogistic reasoning have been found to be influenced by cultures in fundamental ways (e.g., Nisbett, Peng, Choi, & Norenzanan, 2001; Peng, Ames, & Knowles, 2001), this research attempted to explore the different effects this type of dialectical thinking may have on problem finding for two different major ethnic/cultural groups, Caucasians and Asians.

PROBLEM FINDING

Creativity is often described as producing solutions that are both novel and useful (Amabile, 1983). Ward et al.

Susannah Paletz is currently at the Learning Research & Development Center at the University of Pittsburgh. Kaiping Peng is in the Department of Psychology, University of California, Berkeley.
This research was supported in part by Hellman Faculty Research funds to Kaiping Peng in 2002 and 2003. We thank Jacquelyn Brown, Elena Cherkasova, Alexia Cooper, Genevieve Cseh, Joanne Feinstein, Ruby Gomez, Yulya Ippolitova, Michele Lee, Pei-Yuan Lin, Sandra Mendez, Naomi Misawa, Golnoush Monfared, Todd Muehlenbeck, Chiharu Yoneyama, Ashley Berry, Heather Caruso, Ellis Doostan, Shion Kim, Kjerstin Barrett, Tim Kraus, and Helen Kwok for their help over the years in data collection, entry, and coding. Lillian Park and Miriam Vega also helped with data collection. We also thank Yuri Tada, Chris Bearman, and three anonymous reviewers for their insightful comments on earlier drafts. The Gordon Allport Society at UC Berkeley, David Walter, Linda and Jack Valentine, Michael Moss, Owen Lincoln, and Seth Sher pilot tested some of the materials. This research was conducted while the first author was at UC Berkeley. Some of the results of Studies 1 and 2 were presented at the Society for Personality and Social Psychology's Annual Conference in 2003, Los Angeles, CA.
Correspondence should be sent to Susannah B. F. Paletz, LRDC 816, 3939 O'Hara Street, Pittsburgh, PA 15260. E-mail: sbfpaletz@gmail.com

(1999) argued that creativity is not a singular process, but is made up of many subprocesses, such as problem finding, preparation, insight, elaboration, and evaluation. Even these separate phases may contain different creative subprocesses (Dunbar, 1997). We propose that dialectical thinking, as an implicit attitude, may influence certain creative processes positively and others negatively. Yet other creative processes may be unrelated to dialectical thinking. Of all the possible creative processes, we chose problem finding because (a) it is assumedly one of the first processes activated in creative thinking and, more important, (b) it is unrelated to field dependence, gender, and intelligence in undergraduates, some of which may be related to other creative processes (Artley, Van Horn, Friedrich, & Carroll, 1980). In particular, field dependence is influenced by culture (e.g., Kuhnen et al., 2001; Ji, Peng, & Nisbett, 2000). Therefore, this study lessens the possibility that any cultural effects act via cultural differences in field dependence. Obviously, future studies should examine other aspects of the creative process in relation to dialectical thinking, as well as dialectical thinking operationalized differently. This research simply begins the examination.

Problem finding is vital to problem solving. It is how one defines a potential predicament. In one example, Getzels (1975) described a pair of people who get separate flat tires while driving through the countryside. The first person notices that he does not have a jack and attempts to find one. The second frames the problem as how to lift the car, and thereby solves the problem faster. Problem finding includes the questions people ask before they solve the problem. Problem finding is not only utilized in obvious problem solving situations; artists who are good at problem finding have their artwork rated as more original, and many become more successful (Csikszentmihalyi & Getzels, 1988). Problem construction, a subprocess of problem finding, has also been shown to be positively associated with problem solving originality and quality (Mumford, Reiter-Palmon, & Redmond, 1994).

Problem finding, itself, is not a single process. It can be broken down to four separate, but related, skills: problem identification or detection, problem definition, problem expression, and problem construction (Runco, 1994a; Runco & Nemiro, 1994). It has even been described as a post-formal operations stage of cognitive development (e.g., Arlin, 1975, 1989), although the theoretical framework of problem finding as a stage will not be used here. Instead, we conceptualized problem finding as a cognitive process that anyone can experience (e.g., Reither-Palmon, Mumford, O'Connor Boes, & Runco, 1997). Problem detection, where a problem is ascertained from an ill-defined domain, includes attention and perception (e.g., Klein, Pliske, Crandall, & Woods, 2005; Mumford et al., 1994). Therefore, even with problem finding, there are different cognitive processes, both clearly creative and not. Furthermore, how clearly the problem is presented to the research participant divides problem finding tasks along a continuum from *potential problems* (least clear) through implicit problems to *evident problems* (most clear; Dillon, 1982). Problem finding has been operationalized in different ways, from a number of questions (e.g., Artley et al., 1980) to questions about, or arrangements of, an array of objects (e.g., Arlin, 1975; 1989) to the rated creativity of the rephrasing of problems (e.g., Reiter-Palmon et al., 1997). Because the studies in this article utilize evident problems, conceptually this study focused more on the latter stages of problem construction than on problem detection or identification. The tasks we chose involved rephrasing and potentially reframing a given problem.

Dialectical Thinking and Culture

Dialectical thinking was conceived in these three studies as implicit theories and cognitive styles relating to contradiction and change. It is different from philosophical systems based on dialectical processes, such as Hegelian or Marxist dialectics, as well as the techniques designed to encourage interpersonal level debates, counter arguments, and confrontation, such as the dialectical inquiry technique (e.g., Cosier & Dalton, 1982; Valacich & Schwenk, 1995).

Recent cross-cultural research has found that the notion of dialectical thinking is not culture free. Western dialectical thinking often reflects a sophisticated and advanced cognitive style that attempts to reach syntheses over contradiction (Basseches, 1980; Riegel, 1973). A separate East Asian type of dialectical thought has been proposed (Peng & Nisbett, 1999), where dialectical thought is less troubled by contradiction and accepts the coexistence of the opposites, even the unity of the thesis and antithesis. In this view, belief in genuine contradiction may be considered to be a thought error or indication of immaturity (Peng & Nisbett, 2000). This Asian version of dialectical thinking is likely based on East Asian-specific folk beliefs (implicit theories) of knowing, labeled as *naive dialecticism* (Peng & Nisbett, 1999). There are three main components in this folk epistemology: the theory of change, the theory of contraction, and the theory of holism. These ways of knowing derive from East Asian philosophical and religious traditions, including Confucianism, Taoism, and Buddhism, and are dominant lay belief systems among numerous Confucian-based cultures, including those in China, Japan, and Korea (Peng, Spencer-Rodgers, & Zhong, 2006). In contrast, Western folk epistemologies (lay theories of knowing) tend to be more linear and less likely to be dialectical; they are *synthesis-oriented* and tend to

emphasize stability, coherence, and the resolution of contradiction, at best, through integration and synthesis (Festinger, 1957; Heider, 1958; Lewin, 1951). The principal distinction between Western dialectical thinking and Eastern dialectical thinking may lie in the relative emphasis placed on synthesis in the West. In Western philosophy and religion, *dialecticism* refers to an epistemological or historical process that is progressive. Through dialogue, logical analysis, negotiation, or even violence (e.g., between the social classes), contradiction is ultimately resolved and synthesis is achieved (thesis–antithesis–synthesis). In East Asian philosophy, however, history is more often seen as circular and contradiction is viewed as a state of tension or conflict that need not ever be resolved. Opposing phenomena, such as love and hate, are mutually constituted—one cannot exist without the other—and ever-present. They exist in a state of balance forever and synthesis may never be achieved (yin/yang).

There is mounting evidence suggesting the East Asian naive dialecticism affects psychological processes in fundamental ways. The implication is that East Asians are often more tolerant of the coexistence of opposing traits, emotions, and attitudes within themselves (Choi & Choi, 2002; Schimmack, Oishi, & Diener, 2002; Spencer-Rodgers, Peng, Wang, & Hou, 2004). For instance, individuals with dialectical self-views may conceive of themselves as both generous and selfish simultaneously. Also, East Asians, on average, are more likely to tolerate psychological contractions (Peng & Nisbett, 1999, 2000), are less surprised by contradictory evidence (Choi & Nisbett, 2000), and follow rules in categorization less (Norenzanan et al., 2002). In general, East Asians are more sensitive to change, more tolerant of contradiction, and hence are more holistic in their cognition (Nisbett et al., 2001).

As culture influences cognition in many areas, the relationship between dialectical thinking and creative processes needs to be reevaluated. Dialectical thinking may have different consequences for Caucasians and Asians in the domain of creativity.

Dialectical Thinking and Creativity

Dialectical thinking has been suggested to be positively associated with creativity. Rothenberg (1996), for example, described the *Janusian process* in scientific creativity, whereby the creator goes through several phases: (a) immersion in a field and motivation to create; (b) a focus on one or both of the two elements to be resolved but in a way that deviates from prior attempts; (c) antithesis, where the two opposing elements are brought together in a way that leads to a creative outcome; and (d) the elaboration and deepening of the theory. The Janusian process can also be applied to the insights of artists and therapists (Rothenberg, 1994). In this line of research, the Janusian creative process is a dialectical process (albeit conceptualized from a Western perspective).

Another theory breaks down the relationship between creativity and dialectical thinking as a cognitive strategy (Benack et al., 1989). Benack et al. argued that dialectical thinking, as an understanding of reality, thought, and the interrelation of systems, supports creativity and is postformal. Specifically, dialectical thinking leads to breaking sets, attention to contradiction and synthesizing contradiction, being aware of the complex relationships between things, and understanding that one's own thoughts will change. All of these, in turn, lead to increased creativity. This could also be the case for problem finding. Specifically, individuals who are comfortable with breaking sets, consider seemingly contradictory information simultaneously, and take change for granted would be more likely to construct the problem itself in a broader, more original fashion. A problem that might be conceived as how to fix a flat tire might be thought of, by a more dialectical person, as how to get the car moving again.

This argument is similar to Arlin's (1976) suggestion that a problem finding stage of cognitive development could be the opposite side of the same coin as dialectical operations, such that "dialectical operations may be the functional dynamic of creative thought" (p. 250). Her later research found a positive correlation between dialectics and problem finding question quality in a sample of young (15–19-year-old) artists and scientists (Arlin, 1989) and that problem finding and dialectical thinking loaded together as a single factor in a small sample of gifted students (Arlin & Levitt, 1998).

Therefore, a positive connection was predicted between dialectical thinking and problem finding.

> Hypothesis 1: Naive dialectical thinking, conceptualized broadly as a culturally influenced cognitive style, and creativity in a problem finding task will be positively related.

However, based on the differences described above between Asians and Caucasians in folk epistemologies related to dialectical thinking, a second hypothesis was necessary. Although the focus of the study was on the originality of problem finding, rather than problem resolution, we must accept the possibility that dialectical thinking has different consequences for Asian and Caucasian originality. However, the direction of those consequences is exploratory.

> Hypothesis 2: The relationship between dialectical thinking and creativity will be different for Caucasians and Asians/Asian Americans, such that ethnicity acts as a moderator.

STUDY 1

First it was determined whether or not there is a simple relationship between naive dialectical thinking and problem finding across a diverse sample. This first study measured naive dialectical thinking using a scale of implicit theories about dialectical thinking (Spencer-Rodgers et al., 2008, used in Spencer-Rodgers et al., 2004) and then correlated it with problem finding based on Reiter-Palmon et al.'s (1997) problem construction tasks). The interaction between ethnicity and dialectical thinking on problem finding was also tested.

Method

Participants

One hundred and forty-five undergraduates took part for research participation credit as a partial course requirement at the University of California, Berkeley. Sixty-seven percent of the participants were female, and 32% were male. Although only 62% had been born in the United States, 82% lived most of their lives there. In terms of ethnicity, 52% of the participants were Asian or Asian American, 32% were Caucasian, 7% were Hispanic, and 5% were African American, Other, or reported multiple ethnicities.[1] Their average age was 21 years old.

[1]For this study, as with all three studies, race/ethnicity was elicited through an open-ended question and then coded into Census (1995) categories. The term Caucasian is used rather than European American because, according to the Census, Caucasians include groups such as Middle Easterners and North Africans who are not technically European (e.g., Iranians). Because of the open-ended nature of the question, it was often not possible to distinguish between Caucasians of purely European descent and those from Middle Eastern or North African descent. The majority of Caucasian participants simply identified themselves as *Caucasian* (Study 1: 78%; Study 2: 69%; Study 3: 60%). Although there are obvious cultural and ethnic differences between Iranians and Northern Europeans, there are similarly cultural and ethnic differences between Koreans and Chinese. These do not deny the existing literature on differences in naive dialectical thinking, however (e.g., Peng & Nisbett, 1999). Similarly, in terms of the Asians and Asian Americans, only 6 participants self-identified as Indian or South Asian for Study 1 and only 13 for Study 2. All the rest self-reported as a type of East Asian (e.g., Japanese, Chinese, Korean, etc.), Filipino, or simply *Asian* or *Asian American*. For Study 1, 83% of the Asian/Asian-American sample had lived most of their lives in the United States and 50% were born there. For Study 2, 77% of Asian/Asian-Americans had lived most of their lives in the United States and 49% were born there. For the Study 1 sample, there were no significant differences in dialectical thinking, plausibility, originality, or number of responses between the Asia-born Asians and the American-born Asians. For Study 2, Asian-born Asians had significantly higher scores on the behavioral and cognitive change subscales of the dialectical thinking scale, but there were no significant differences for plausibility, originality, or number of responses. There were no significant interaction effects between dialectical thinking and birthplace on originality for the Asian sample for either study. The sample sizes were too small to test other differences, and length of time spent in the United States was not collected.

Measures

The respondents first filled out the 32-item Dialectical Self Scale (DT; Spencer-Rodgers et al., 2008, as used in Spencer-Rodgers et al., 2004). This questionnaire is composed of three different subscales of naive dialectical thinking: acceptance of contradiction, behavioral change, and cognitive change. Each item and subscale is on a scale from 1 (*strongly disagree*) to 7 (*strongly agree*). Examples of questions from the first, second, and third subscales, respectively, are as follows: (a) "My world is full of contradictions that can't be resolved," (b) "I find that my values and beliefs will change depending on who I am with," and (c) "I often change the way I am, depending on who I am with." Roughly half of the subscales are negatively worded items, such as "My core beliefs don't change over time." This balances out any inadvertent effects that would result from taking a scale focusing on dialecticism or any biases due simply to acquiescence. For this first study, Cronbach's alphas for the naive dialectical scale were acceptable (see Table 1). Given the known diversity of the sample, they were also asked for their countries of birth and countries of residence for the majority of their lives in addition to the usual questions about gender, age, and race/ethnicity.

Problem restatements. The respondents worked on three tasks based on Reiter-Palmon et al.'s (1997; also Reiter-Palmon, Mumford, & Threlfall, 1998) problem construction tasks. After being shown an example, each participant was given a problem and then asked to restate it in as many different ways as possible. The participant was asked to use a format such that each

TABLE 1
Cronbach's Alpha for Dialectical Self Scale

Dialectical Self Scale[a]	*Asians/Asian Americans*[b]	*Caucasians*[c]	*Whole Sample*[d]
Study 1			
Contradiction	.78	.69	.75
Cognitive change	.74	.63	.71
Behavioral change	.64	.66	.64
Entire scale	.85	.80	.84
Study 2			
Contradiction	.72	.53	.69
Cognitive change	.73	.67	.71
Behavioral change	.64	.42	.59
Entire scale	.83	.69	.81

[a]Contradiction subscale is 13 items; cognitive change is 11 items; behavioral change is 8 items; entire scale is 32 items.

[b]For Study 1, Asian/Asian American $n = 75$; for Study 2, $n =$ 169–172.

[c]For Study 1, Caucasian $n = 44$–46; for Study 2, $n = 59$–60.

[d]For Study 1, whole sample $n = 141$–143; for Study 2, $n = 272$–276.

problem restatement would start with the phrase, "How do I . . .?" Although the structure of the assignment was based on Reiter-Palmon et al.'s tasks, the stem problems themselves were created for this study. These three tasks covered three different everyday problem areas. The first problem stem was "I am in a new city and need dinner," the second was "I haven't finished my assignment and it is due in 10 minutes," and the third was "I want to invite two of my friends to a 10-person social gathering, but they don't like each other." The respondents could write up to 20 restatements for each question. For example, common restatements of the first problem were, "How do I get dinner?" and "How do I find a good place to eat dinner?"

Coding for creativity. Each of the three sets of restatements was coded using a modified version of the Consensual Assessment Technique (CAT; Amabile, 1996) based on Reiter-Palmon et al. (1997)'s method. Each set of questions was rated from 1 to 5 by independent coders. However, unlike the original Amabile CAT, the coders were trained in the use of the scale before they began and the scale had anchors for each number. Each set was rated on its originality and plausibility by five undergraduate coders. The intraclass coder correlation means across the different problem tasks were .75 for plausibility and .77 for originality.

The mean plausibility for the three sets of problems was from 3.5 to 3.65 (on a 1 to 5 scale), and the mean originality ranged from 2.5 to 2.6 (also on a 1 to 5 scale). The mean number of responses elicited between the three sets of problems ranged from 7.4 to 9. One way of examining the restatements was to treat the three different sets as different items on a three-item scale. Examined in this manner, the scale alpha for the number of responses was .94, for plausibility was .59, and for originality was .83. For the rest of the analyses, all three sets were combined to give single plausibility, number, and originality scores.

Results

Results were analyzed using linear regression or *t*-tests after standardizing each variable (although unstandardized means are presented for clarity). Originality was the most direct creativity variable for this study. The number of restatements also serves as a measure of fluency. Because these hypotheses have been previously untested, nonsignificant results with each of the dialectical thinking subscales will be presented for Study 1.

Hypothesis 1

Across the entire sample, there was no association between originality and naive dialectical thinking, either for the whole dialectical scale, or for the individual subscales (see Table 2). There were also no significant associations between the number of restatements and dialectical thinking or plausibility and dialectical thinking (see Table 2).

Hypothesis 2

Given the cultural differences in dialectical thinking as noted above, it was entirely possible that dialectical thinking was associated with these creativity measures differently for different groups. There were a sufficient number of Asians and Asian Americans (76) and Caucasians (46) to test for mean differences between these groups. There were insufficient numbers of members of other groups to do a detailed analysis ($n = 21$, total).

First, it is important to note that there were no differences between Asians/Asian Americans and Caucasians on originality, number of restatements, or plausibility. On the behavioral change subscale, Asians and Asian Americans ($M = 3.71$) did score significantly higher than Caucasian participants ($M = 3.30$), $t(120) = -2.91$, $p = .004$. The differences between these two groups on the contradiction subscale of dialectical thinking were not significant, although on the cognitive change subscale, the Asians and Asian Americans ($M = 3.58$) trended slightly, but not significantly, higher than Caucasian participants ($M = 3.32$), $t(120) = -1.90$, $p = .06$. On the overall scale, Asians and Asian Americans ($M = 3.88$) did not score significantly higher than Caucasian participants ($M = 3.66$), $t(115) = -1.93$, $p = .056$.

The best way to show that ethnicity acted as a moderator for the relationship between dialectical thinking and creativity is to test for an interaction effect. The interaction vector was the product of the dummy coded Caucasian/Asian variable and naive dialectical

TABLE 2
Study 1: Regression Analyses of Dialectical Self Scale and Originality, Number of Responses, and Plausibility

Source	R^2	*t*	*df*	β	*p*
Originality					
Contradiction	.005	−0.82	143	−.07	.41
Cognitive change	.004	−0.80	143	−.07	.43
Behavioral change	.001	−0.37	143	−.03	.71
Entire scale	.003	−0.63	137	−.05	.52
Number of restatements					
Contradiction	.001	0.46	143	.04	.65
Cognitive change	.001	−0.30	143	−.03	.76
Behavioral change	<.001	−0.02	143	<− .01	.99
Entire scale	.001	0.31	137	.03	.76
Plausibility					
Contradiction	.002	0.49	143	.04	.63
Cognitive change	.002	−0.53	143	−.04	.60
Behavioral change	.02	1.63	143	.14	.11
Entire scale	<.001	0.15	137	.01	.88

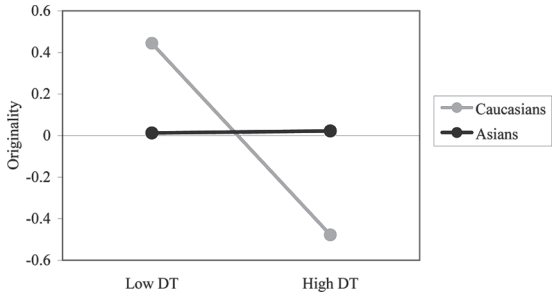

FIGURE 1 Study 1: Problem Finding Originality by Low and High Naïve Dialectical Thinking for Asians/Asian Americans and Caucasians.

thinking. The results showed significant interaction effects controlling for the potential main effects of ethnicity and dialectical thinking, such that higher naive dialectical thinking on the whole scale was *negatively* related to originality for Caucasians but not for Asians, $\Delta R^2 = .04$, $F(1, 113) = 4.73$, $p = .032$ (see Figure 1). This finding was driven by a significant interaction effect for behavioral change, $\Delta R^2 = .046$, $\Delta F(1, 118) = 5.75$, $p = .018$. The interaction effect for contradiction was not significantly related, $\Delta R^2 = .03$, $\Delta F(1, 118) = 3.69$, $p = .057$, nor was the interaction effect with cognitive change significant, $\Delta R^2 = .007$, $\Delta F(1, 118) = 0.81$, $p = .37$. Even though the number of responses was highly correlated with the originality of the responses, this interaction effect was not significant for the number of responses across any of the naive dialectical thinking subscales: not for the whole scale, $\Delta R^2 = .004$, $F(1, 113) = 0.49$, $p = .49$, the contradiction subscale, $\Delta R^2 = .004$, $\Delta F(1, 118) = 0.52$, $p = .47$, the cognitive change subscale, $\Delta R^2 < .001$, $\Delta F(1, 118) = 0.003$, $p = .96$, nor the behavioral change subscale, $\Delta R^2 = .006$, $\Delta F(1, 118) = 0.42$, $p = .52$.

Discussion

Most of these results were not significant, revealing no association between dialectical thinking and creativity overall (see Table 2). The results revealed a significant interaction effect such that the association between naive dialectical thinking and creativity was in the negative direction for Caucasians. This effect was not very strong. Therefore, there was support for Hypothesis 2, but the findings were in the opposite direction for Hypothesis 1 for Caucasians. It is also important to note that the finding was for the rated originality of the statements, not the number of statements (a typical measure of fluency or divergent thinking) or the plausibility of those statements. This suggests that originality and the number of statements are qualitatively different measures of creativity when it comes to dialectical thinking. These findings are contrary to previous theorizing about dialectical thinking. The suggestive evidence for Hypothesis 2 would recommend further study into the relationship between dialectical thinking and creative processes. Of course, the domain used in this study, everyday life issues, may also contribute to the negative relationship between dialectical thinking and creativity. The questions themselves do not present any contradictory elements that may trigger dialectical thought processes; the instructions may indicate a linear solution to the problems.

STUDY 2

The aim of this study was to replicate and extend the previous study's findings. This was accomplished by introducing a new problem finding task to test its relationship with the dialectical thinking orientation measured in Study 2. Although structured somewhat similarly, this problem finding task focused on creativity in scientific domains, rather than on everyday issues. Accordingly, the demographics section also asked participants questions about their science backgrounds. Also, the new task required "deeper problem finding," or more cognitive effort, on the part of the participants. The first study involved a task where the problem was clearly presented. This would be considered on the "evident" end of the continuum of problem finding, as opposed to the end where problems are ambiguous and "potential" (Dillon, 1982). In this follow-up study, we presented participants with possible scientific research findings, which were more ambiguous than the everyday problem restatements, and asked them to come up with related research questions.

Another addition to the study was in the instructions to the coders, such that the plausibility dimension was changed to appropriateness. Study 1 replicated directly the definitions of plausibility as used in Reiter-Palmon et al. (1997). However, the creativity literature typically identifies *appropriateness* as the second dimension of creativity (e.g., Amabile, 1983, 1996; Stein, 1953), which is broader than plausibility. Appropriateness focuses not simply on how possible a solution is, but how much it fits the problem as a solution. This study better reflects the theorizing about the nature of creativity as discussed in the literature. Also, because the sample included so many participants not born in the United States, a question was added to the demographics to ascertain (and control for) whether English was their native language.

Methods

Participants

Two hundred and seventy-nine undergraduates at the University of California, Berkeley, participated in the

study. One hundred and forty-seven were recruited from an introductory psychology class for non-majors, and 132 were recruited from a cultural psychology class for psychology majors. For this sample, 59% were female, 41% male; 59% were born in the United States, but 82% had lived most of their lives in the United States. Forty-two percent reported that English was not one of their first languages. Ethnically, the sample was 62% Asian or Asian-American, 22% Caucasian, 7.5% Hispanic, and 8.6% African-American, Other, or Mixed (of which only 1.8% were African-American). An example of "Other" is "human race." Their average age was 21 years old.

Measures

As with Study 1, the participants were administered the dialectical self scale and then completed the two scientific question generation tasks, followed by a demographics page.

Dialectical self scale. The dialectical self scale was the same as in Study 1. The alphas were fair to good (see Table 1).

Scientific question generation. The participants were presented with two scientific question generation tasks. The participants were asked to write down as many different research questions as they could based on two different scientific problems: (a) "Pretend that you are a scientist who is studying monkey behavior in Africa. You see some of the monkeys eating dirt. Usually they just eat leaves and fruit," and (b) "You are taking photographs using a new type of film that captures electromagnetic radiation. Your pictures show a hazy glow around plants and animals but not around street signs or furniture." Unlike the other problem construction questions, these were less specific about what the problem is, requiring the participant to come up with ways of explaining the situation.

Demographics. In addition to the information collected in Study 1, the demographics information in Study 2 included questions about how many courses the participants had taken in biology and physics. The participants were also asked to assess their own biology and physics knowledge on two scales ranging from 1 (*very low*) to 7 (*very high*).

Coding for creativity. The coders were directed to assess the statements' appropriateness. Rather than the general directions about the plausibility of the responses, the instructions for appropriateness were more detailed, better matching the directions for originality. The anchors for appropriateness went from 1 (*very low appropriateness; research questions seem bizarre and tangential to the problem; there is little or no attempt to address the problem*) to 5 (*very high appropriateness; research questions are insightful ways of addressing the root of the problem and seem to fit the situation presented in a remarkably astute way*). Plausibility was, therefore, subsumed under appropriateness. The instructions for originality were the same as with Study 1 (i.e., Reiter-Palmon et al., 1997).

Five psychology undergraduates coded the creativity tasks on originality and appropriateness. The mean intraclass correlation (interrater reliability) was.78 for originality and .70 for appropriateness. The number of statements written down was strongly positively associated across the two questions (Cronbach's alpha = .86). Similarly, the originality hung together adequately as a two-item "scale" (Cronbach's alpha = .67), as did appropriateness (Cronbach's alpha = .63). The average originality rating across the two scientific research questions on a 1 to 5 scale was 3.1; the average appropriateness rating, also on a 1 to 5 scale, was 3.0. The average number of statements was 8.7.

Results

Because English as a second language was not correlated with any of the dependent variables (originality, appropriateness, and number of responses on any of the tasks), it was not controlled for in any of these analyses. There was a slight positive correlation between number of biology courses taken and originality ($r = .13$, $p = .04$, $N = 232$) and a slight negative correlation between self-reported physics expertise and originality ($r = -.12$, $p = .04$, $N = 277$). These variables were controlled for in the relevant analyses. The dependent variables were standardized across the whole sample, although unstandardized means will be presented.

Hypothesis 1

First, we analyzed the relationship between creativity and naive dialectical thinking. Across the entire sample, there was a slight significant positive association between the entire naive dialectical thinking scale and originality on the research questions, $R^2 = .014$, $t(275) = 1.98$, $p = .049$, $\beta = .13$. There were no significant associations between the entire scale and appropriateness or number of responses. Examining single order correlations, this association was likely driven by positive significant correlation between the contradiction subscale and originality ($r = .15$, $p = .015$, $n = 277$). There was also a small positive correlation between the contradiction subscale and the number of responses

($r = .16$, $p = .01$, $n = 277$). The correlations between originality and either cognitive or behavioral change were not significant.

Hypothesis 2

There were no significant differences between Caucasians and Asian/Asian Americans on originality, appropriateness, or number of responses on the scientific task itself. Asians and Asian Americans ($n = 172$) trended higher, but not significantly than the Caucasians ($n = 61$) on their overall score on the dialectical scale, $t(1, 135.45) = -1.86$, $p = .06$ (Asian/Asian American, $M = 3.96$; Caucasian, $M = 3.83$) and on the behavioral change subscale, $t(1, 124.15) = -1.89$, $p = .06$ (Asian/Asian American, $M = 3.81$; Caucasian, $M = 3.61$). Equal variances were not assumed because the test of homogeneity was significant.

Examined separately and controlling for number of biology courses taken and self-reported physics expertise, naive dialectical thinking was significantly positively associated with originality on the science task for Caucasians, $\Delta R^2 = .079$, $\Delta F(1, 46) = 4.42$, $p = .041$, but not for Asians/Asian Americans, $\Delta R^2 = .003$, $\Delta F(1, 140) = 0.40$, $p = .53$. However, the interaction effect (test for the vector of ethnicity × dialectical thinking) that would be expected from this was not significant, $\Delta R^2 = .013$, $\Delta F(1, 188) = 2.62$, $p = .107$, controlling for the main effects for race/ethnicity, the naive dialectical thinking scales, number of biology courses, and self-reported physics expertise.

There was a similar finding for the contradiction subscale and the number of science research questions: For Caucasians, their contradiction subscale score was positively associated with the number of statements, $R^2 = .091$, $\beta = .34$, $t(57) = 2.39$, $p = .02$, but this was not the case for the Asians/Asian Americans, $R^2 = .007$, $\beta = .09$, $t(170) = 1.39$, $p = .26$, and the interaction vector was not significant, $\Delta R^2 = .008$, $\Delta F(1, 227) = 1.97$, $p = .16$. These findings mean that although there was a significant relationship for the Caucasians, the association between dialectical thinking and originality for them was not significantly higher than the lack of association for the Asians/Asian Americans. There was no relationship between dialectical thinking for either group with appropriateness or for the behavioral or cognitive change subscales with originality.

Discussion

Study 2's findings seemingly contradicted those of Study 1, showing an overall, slight relationship for naive dialectical thinking and problem finding in the positive direction. There are many potential reasons for the different direction of the relationship. Even though both were problem finding tasks, there were differences between the tasks. Perhaps the different tasks incorporated different levels of contradiction. After all, for Study 2, the findings for the entire naive dialectical thinking scale seem to be driven by the contradiction subscale. It appears as though more contradiction might be involved in, for example, a problem involving monkeys eating dirt than in a problem involving being lost in a new city.

So far, the support for Hypothesis 1 is contradictory. Study 2 found a positive association between dialectical thinking and originality (although when separated, this was the case for Caucasians, not Asians/Asian Americans). Study 1 showed support for Hypothesis 2, where dialectical thinking was negatively related to originality but only for Caucasians. This contradiction for Caucasians implies that the relationship between dialectical thinking and originality is more complicated than previously thought. A third study focusing on Caucasians was clearly necessary to explain better the findings for that group.

STUDY 3

The third study focused on Caucasians, thus testing Hypothesis 1 and only for that group. This study had two experimental manipulations yielding a 2 (dialectical vs. linear thinking) by 2 (low vs. high contradiction) design. A dialectical versus linear prime was delivered before scientific question generation tasks similar to those in Study 2, and the question generation tasks were varied experimentally in terms of how much contradiction was inherent in them. We hypothesized an interaction effect such that low contradiction problems would result in lower originality for the dialectical prime, whereas high contradiction problems would have heightened originality from the dialectical prime.

Methods

Participants

One hundred and twenty-eight Caucasian undergraduates at the University of California, Berkeley, participated in the study. All of the participants were recruited via the psychology department's research participation pool. In terms of gender, 62.5% were female and 37% male (one did not report). Seventy-two percent were born in United States and 81% had lived most of their lives in United States (87% reported living in the United States, North America, America, or Canada). Seventy-five percent reported that English was their first language, although not necessarily exclusively so—5.5% were bilingual. Their average age was 21 years old.

Measures

Demographics. As with Study 2, the demographics section included questions about how many courses the participants had taken in biology and physics in addition to questions about birthplace, etc.

Dialectical thinking. In order to control for implicit theories about dialectical thinking, the participants filled out the same naive dialectical thinking scale as was given in Studies 1 and 2 (for the contradiction subscale: Cronbach's alpha = .78, $n = 126$; cognitive change: Cronbach's alpha = .74, $n = 127$; behavioral change: Cronbach's alpha = .66, $n = 128$; entire scale: Cronbach's alpha = .86, $n = 125$, items = 32).

After the demographics section, the respondents were given a prime designed to encourage either dialectical or linear thinking (Parker-Tapias & Peng, 2001). Subjects were instructed to write about an experience from their adolescence. Depending on the condition, this experience was either about (a) a time in their lives when thinking about the world as being full of change or contradiction and looking at issues from different perspectives (being dialectical) helped them, or (b) when being able to think of the world as being stable and consistent and discover the truth (in other words, thinking analytically and linearly) had been useful. Previous research has shown that this prime has successfully induced a temporary dialectical or linear/analytic thinking style (Parker-Tapias & Peng, 2001).

Contradiction manipulation. At this point, the participants filled out two scientific question generation tasks, the order of which was counterbalanced between subjects. The two scientific problems were one on monkey eating habits similar to the one in Study 2 and a new one on the effects of global warming. The problem relating to electromagnetic radiation in Study 2 was not included in this study because it had occasionally elicited comments indicating that it was perceived to ignore known aspects of electromagnetic radiation.

The problems themselves were varied between participants by the level of contradiction inherent in them. Both problems were worded to have either high contradiction or low contradiction. These levels were chosen via pretesting with 21 volunteers.

The two high contradiction problems were: (a) "Pretend that you are a scientist who is studying monkey behavior in Africa. You see some of the monkeys eating dirt. Usually they just eat leaves and fruit" and (b) "Pretend you are a scientist studying climate change using historical geological and fossil evidence. You notice that in the past, a very short period of global warming (say, 20 years) is followed by extremely cold weather for at least 100 years. It looks as though global warming might cause an ice age for the following century." The two low contradiction problems were: (a) "Pretend that you are a scientist who is studying monkey behavior in Africa. You see some of the monkeys eating insects. Usually they just eat leaves and fruit" and (b) "Pretend you are a scientist studying climate change using historical geological and fossil evidence. You notice that in the past, a very short period of global warming (say, 20 years) is followed by extremes in weather and temperature for at least 100 years. It looks as though global warming might cause powerful storms and weather extremes for the following century."[2] Repeated measures tests using the pilot sample revealed that for the question regarding monkey eating habits, eating dirt had significantly more perceived contradiction than eating insects, partial $\eta^2 = .436$, $F(1, 20) = 15.45$, $p = .001$ (on a 1 to 7 scale, eating insect $M = 2.71$, $SD = 1.42$; eating dirt, $M = 4.29$, $SD = 1.65$). For the question about global warming, an ice age was considered a more contradictory outcome than extremes in temperature, partial $\eta^2 = .566$, $F(1, 20) = 26.04$, $p < .001$ (extremes in temperature, $M = 2.62$, $SD = 1.47$; ice age, $M = 5.05$, $SD = 1.80$).

Coding for creativity. Six undergraduates coded the results from the four question generation tasks on originality and appropriateness, as with Study 2. The coders were given each set to code separately for each question. Each participant, however, received only two scientific question generation tasks, either high or low contradiction. The mean intraclass correlations (interrater reliability) were .78 for originality (.79 for high contradiction problems and.78 for low contradiction problems) and.66 for appropriateness (.64 for high contradiction and .68 for low contradiction problems). As before, the number of statements produced was strongly associated across each of the two problems the participants received (for high contradiction problems, Cronbach's alpha = .82, $n = 65$ participants; for low contradiction problems, Cronbach's alpha =.77, $n = 63$ participants). The average originality and appropriateness ratings were near the midpoint of the 1 to 5 scale (originality $M = 3.15$; appropriateness $M = 3.10$). On average, 8.4 research questions were written down, with a range of 2 to 18.

Results

As with Studies 1 and 2, all variables were standardized across the sample.

[2]The data from this study were collected in the spring of 2003, well before the ideas that global warming may have these effects were popularized via the movie *The Day After Tomorrow*.

Manipulation Check

To test whether the prime had an effect on the types of essays written, the manipulation check by Parker-Tapias and Peng (2001) was used. The number of transitional words and qualifiers in each essay were compared between the two conditions. Examples of transitional words include *however, but*, and *on the other hand*. Examples of qualifier words include *too much, sometimes*, and *due to the circumstances*. Using a two-tailed test, the participants given the dialectical prime were not significantly more likely to use transitional and qualifier words, controlling for scale measured naive dialectical thinking, $\Delta R^2 = .03$, $\Delta F(1, 125) = 3.87$, $p = .051$.

Covariates

Scale measured naive dialectical thinking was not related to originality, appropriateness, or number of responses, suggesting that perhaps the prime was actually successful. Nor was the interaction between scale measured dialectical thinking and the contradiction manipulation related to any of the dependent variables. There were no order by prime or order by contradiction effects for originality, appropriateness, or number of responses. Single-order correlations showed positive associations between English as a first language with appropriateness and number of research questions ($r = .21$, $p = .016$, $N = 128$ and $r = .22$, $p = .013$, $N = 128$, respectively). Therefore, analyses with these dependent variables controlled for English as a first language. Unlike with Study 2, number of biology courses and expertise in physics were not correlated with originality ($r = .09$, $p = .33$, $N = 107$ and $r = .02$, $p = .84$, $N = 128$, respectively); however, physics expertise was negatively correlated with appropriateness ($r = -.18$, $p = .047$, $N = 128$, respectively). There was also a significant effect for order, but only on appropriateness, partial $\eta^2 = .052$, $F(1, 120) = 6.65$, $p = .011$. Analyses controlled for these covariates when appropriate.

Experimental Manipulations: Dialectical Thinking and Contradiction

The dialectical/linear prime, contradiction manipulation, and the interaction between them did not significantly influence the number of research questions elicited. Nor was appropriateness influenced by the dialectical prime or by the interaction, or was originality affected by the prime or the contradiction manipulations alone. However, appropriateness was influenced by the contradiction manipulation, such that lower contradiction problems elicited more appropriate questions, partial $\eta^2 = .068$, $F(1, 102) = 7.41$, $p = .008$.

More theoretically important, there was a significant interaction effect between the dialectical prime and the contradiction manipulation on originality after controlling for main effects, partial $\eta^2 = .033$, $F(1, 124) = 4.18$, $p = .043$. The linear prime had a greater positive effect on the low contradiction problems than on the high contradiction problems (see Figure 2).

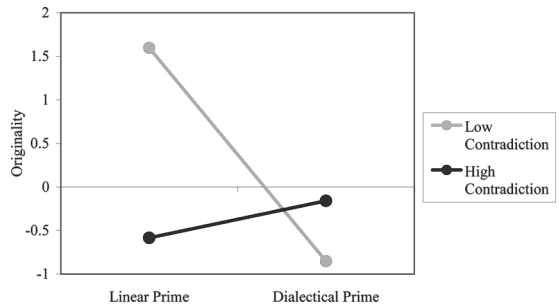

FIGURE 2 Study 3: Problem Finding Originality by Linear and Dialectical Primes for Low and High Contradiction Problems.

Discussion

This study begins to explain the disparate findings for dialectical thinking on problem finding in Caucasians. It differs from the previous studies by experimentally manipulating both dialectical thinking and contradiction. Amount of contradiction inherent in the problem was clearly important for dialectical thinking to have an effect. It seems obvious that information and tasks are not equal in terms of amount of contradiction or implied contradiction. However, the dialectical prime did not have a significantly stronger positive effect on the high contradiction problems, ruling out a task-prime similarity explanation.

GENERAL DISCUSSION

The problem of creativity and how to encourage it has plagued researchers and consultants for decades. Dialectical thinking has been offered as a way of increasing creativity, as a cognitive style and lay epistemology (e.g., Benack et al., 1989), as a structured method of problem solving (e.g., dialectical inquiry, Cosier & Dalton, 1982), and as a later stage of cognitive development (e.g., Arlin, 1976). Taken together, these three studies showed a complex relationship between naive dialectical thinking and originality. Originality in high contradiction problems was either not influenced (Study 3) or slightly positively associated with dialectical thinking (Study 2). Originality in low contradiction problems was negatively related to naive dialectical thinking (Studies 1 and 3). These associations only existed for Caucasians: Study 1 and Study 2 showed that Asians and Asian Americans' originality was unrelated to naive

dialectical thinking. This research shows that cultural differences and different kinds of tasks should be given more prominence in our discussion of dialectical thinking and creative processes.

Why was naive dialectical thinking associated with less originality for Caucasians? Even though it utilized a different method, the dialectical inquiry technique has also been found to be *less* associated with creativity than expected (Cosier & Dalton, 1982). The lack of mediating variables bemoaned in the dialectical inquiry research (Katzenstein, 1996) is true for these studies as well. However, this study found one clear intervening variable: the amount of contradiction inherent in the task itself. It seemed that the contradiction within the questions could impair Caucasian participants' originality when they were primed to think dialectically.

Although not consistent with other previous research and theorizing (e.g., Arlin, 1976), these findings seem to be consistent with Western scientific traditions. In Western science, the laws of non-contradiction form the foundations of scientific investigation (e.g., Popper, 1959/1972). We begin our scientific inquires by attempting to confirm our hypothesis and falsify the other sides (as with the confirmation bias, as well). With the help of institutionally installed adversaries, we achieve collective creativity and progress in science. On the other hand, a naive dialectical approach to questions that are contradictory—an approach that, as mentioned previously, presumes that contradictions need not be synthesized—might make people accept things at face value, thereby failing to generate counterarguments for any statements and possibly even stopping the search for alternative possibilities. This involves a subtle but important difference with Rothenberg's (1996) suggested Janusian process. Naive dialectical thinking allows for tension that need not be resolved. Runco (1994b; 1999) has suggested that resolving tensions may be one of the bases for creativity.

Another interesting question raised by this research is why naive dialectical thinking had relationships with originality for Caucasians but had no associations for Asians and Asian Americans. Perhaps Benack et al. (1989), Arlin (1976), and Peng and Nisbett (1999) are all correct; maybe dialectical thinking is something reached at the end of a developmental process for Caucasians, but is more culturally accepted and easily reached for Asians. Maybe the need (or lack thereof) for resolving contradiction is what makes it an irrelevant, rather than useful or harmful, process for Asians/Asian Americans with regard to creativity, even problem finding. This begs the question as to what cognitive processes are important for Asian/Asian American creativity. Other research on cultural similarities and differences suggests that one cannot take for granted that creativity works in the same way across cultures. For example, Torrance (1962) found that developmental patterns of creativity differed across cultures; Arab students score consistently higher on creativity in figural tests than American participants (Mar'i & Karayanni, 1983); there are differences and similarities in the importance of novelty and appropriateness to creativity between Chinese, Japanese, and Americans that run counter to stereotypes (although not between Asian Americans and Caucasian Americans; Paletz & Peng, 2008); and although not compared directly with American samples, several studies suggest that lay theories of creativity and personality are different between Westerners and various Chinese groups (e.g., Rudowicz & Hui, 1997; Rudowicz & Yue, 2000). Only future research can answer these questions.

This research had a few weaknesses that could be overcome by additional research. First, this study focused on problem rephrasing and construction. Problem finding, itself, is broader than how it was operationalized in this study. Additional studies should test these relationships with other creative processes that are more obviously related to dialectical thinking such as integration and conceptual reorganization. In addition, this study focused on Caucasians and Asians and Asian Americans. Hispanics, African Americans, Native Americans, and people of different mixed ethnicities should be studied as well. Also, although data were collected on place of birth and where the student lived the majority of his or her life, the length of time spent in the United States was not collected, limiting an exact determination of levels of acculturation. More important, future studies should examine more directly the links between creativity and dialectical thinking for subgroups that explicitly have different traditions of dialecticism. Thus, a study with a larger and more diverse sample could examine differences between East Asians and South Asians, East Asians and Middle Easterners, and so on.

Third, this project may suffer from problems with external validity. Real scientists in the midst of hypothesis generation or experimental design may go through different processes than non-expert college students in a laboratory working on a constrained task (Dunbar, 1997). Also, scientific creativity often occurs in groups, not individually (Dunbar, 1997). The sample being limited to undergraduates could have restricted the range of values on important variables. It is unclear how the range of naive dialectical thinking, creativity, and so on varies in this sample, compared with the general adult (or adolescent) population.

Fourth, the results were often weak. This may be due to a lack of robust reliability for creativity coding and/or the specific subscales of the naive dialectical thinking scale, or due to the effects themselves being very small, necessitating larger sample sizes.

Finally, the dialectical thinking scale may have been problematic for Caucasians. For two of the studies, it had relatively low alphas for that group. Also, as the scale focuses on accepting contradiction rather than resolving it, it was indicative of Asian dialectical thinking, rather than Western dialectical thinking. It would be useful to understand better what it means for a Caucasian to be high (or low) on this type of dialectical thinking. In recent research with second generation Americans, naive dialectical thinking measured with this scale was associated with Big Five Neuroticism and other socially undesirable individual difference measures (Paletz, Orasanu, Tada, Fischer, & Kraft, 2006). It is unclear whether a Caucasian who is relatively high on this type of dialectical thinking is consciously taking on an Asian philosophy or has some other reason for responding in this manner. On the other hand, the scale's results were deepened by the priming study. The dialectical prime did not specify a need to resolve or not resolve contradiction. Also, our nonsignificant results in Study 3 for the scale and the interaction between the scale and the contradiction manipulation suggest that the prime overpowered implicit dialectical thinking.

On the other hand, this study has several strengths. In studying ethnicity as a potential moderator, it demonstrates how cultural background can have an impact on creativity. For the tasks in Studies 1 and 2, there were no significant mean differences for creativity between Caucasians and Asians/Asian Americans. It was only in how dialectical thinking was associated with creativity differently for each group that the effects for ethnicity came through. In addition, this study went beyond the simplistic measure of number of responses to examine originality as assessed by independent coders. In several analyses, the significant findings were only on coder-evaluated originality, rather than the number of responses. Finally, for the first time, this set of studies tested the effects of naive dialectical thinking on a type of creativity (i.e., problem finding). This study was necessarily exploratory, but highlights many areas for future research.

Do these results imply that people should be discouraged from being dialectical while trying to be creative? The answer depends on the amount of contradiction in the task and the cultural background of the manipulation's recipient. For example, in problem detection in many applied settings, the inherent contradiction can be low. Problems may be occurring that have occurred before without bad consequences, or the sign that something is wrong may be that a state is *not* changing. It may well be that the training experts in problem detection involves priming them that certain cues are signs of contradiction—and contradiction should not be simply accepted, but should be remarked upon. In these cases, acceptance of contradiction is undesirable: What should be encouraged is alertness to known and novel contradictions. In order to determine where naive dialectical thinking can be useful or detrimental to originality, we must map out its effects on different processes.

REFERENCES

Amabile, T. M. (1983). The social psychology of creativity: A componential conceptualization. *Journal of Personality and Social Psychology*, *45*, 357–376.

Amabile, T. M. (1996). *Creativity in context: Update to the social psychology of creativity*. Boulder, CO: Westview Press.

Arlin, P. K. (1975). Cognitive development in adulthood: A fifth stage. *Developmental Psychology*, *11*, 602–606.

Arlin, P. K. (1976). Toward a metatheoretcial model of cognitive development. *International Journal of Aging and Human Development*, *7*, 247–253.

Arlin, P. K. (1989). Problem solving and problem finding in young artists and young scientists. In M. L. Commons, J. D. Sinnott, F. A. Richards, & C. Amon (Eds.), *Adult development volume 1: Comparisons and applications of developmental models* (pp. 197–216). New York: Praeger.

Arlin, P. K., & Levitt, L. (1998). A developmental perspective on giftedness. *Creativity Research Journal*, *11*, 347–355.

Artley, N. L., Van, Horn, R., Friedrich, D. D., & Carroll, J. L. (1980). The relationship between problem finding, creativity and cognitive style. *Creative Child and Adult Quarterly*, *5*, 20–26.

Basseches, M. (1980). Dialectical schemata: A framework for the empirical study of the development of dialectical thinking. *Human Development*, *23*, 400–421.

Benack, S., Basseches, M., & Swan, T. (1989). Dialectical thinking and adult creativity. In J. A. Glover, R. R. Ronning, & C. R. Reynolds (Eds.), *Handbook of creativity* (pp. 199–208). New York: Plenum Press.

Census. (1995). Census codes as of August 25, 1995. *Federal Register*, *60*, 44673–44693.

Choi, I., & Choi, Y. (2002). Culture and self-concept flexibility. *Personality and Social Psychology Bulletin*, *28*, 1508–1517.

Choi, I., & Nisbett, R. (2000). Cultural psychology of surprise: Holistic theories and recognition of contradiction. *Journal of Personality and Social Psychology*, *79*, 890–905.

Cosier, R. A., & Dalton, D. A. (1982). Advice for promoting creative thought: An analysis of the dialectic. *Journal of Creative Behavior*, *16*, 176–184.

Csikszentmihalyi, M., & Getzels, J. W. (1988). Creativity and problem finding in art. In F. H. Farley & R. W. Neperud (Eds.), *The foundations of aesthetics, art, and art education* (pp. 91–116). New York: Praeger.

Dillon, J. T. (1982). Problem finding and solving. *Journal of Creative Behavior*, *16*, 97–111.

Dunbar, K. (1997). How scientists think: On-line creativity and conceptual change in science. In T. B. Ward, S. M. Smith, & J. Vaid (Eds.), *Creative thought: An investigation of conceptual structures and processes* (pp. 461–493). Washington, DC: American Psychological Association Press.

Festinger, L. (1957). *A theory of cognitive dissonance*. Stanford, CA: Stanford University Press.

Finke, R. A., Ward, T. B., & Smith, S. M. (1992). *Creative cognition: Theory, research, and applications*. Cambridge, MA: MIT Press.

Getzels, J. W. (1975). Problem-finding and the inventiveness of solutions. *Journal of Creative Behavior*, *9*, 12–18.

Heider, F. (1958). *The psychology of interpersonal relations*. New York: Wiley & Sons.

Ji, L., Peng, K., & Nisbett, R. (2000). Culture, control and perception of relations in environment. *Journal of Personality and Social Psychology*, *78*, 943–955.

Katzenstein, G. (1996). The debate on structured debate: Toward a unified theory. *Organizational Behavior and Human Decision Processes*, *66*, 316–332.

Klein, G., Pliske, R., Crandall, B., & Woods, D. D. (2005). Problem detection. *Cognition, Technology, and Work*, *7*, 14–28.

Kuhnen, U., Hannover, B., Roeder, U., Shah, A. A., Schubert, B., Upmeyer, A., et al. (2001). Cross-cultural variations in identifying embedded figures: comparisons from the United States, Germany, Russia, and Malaysia. *Journal of Cross-Cultural Psychology*, *32*, 365–371.

Lewin, K. (1951). *Field theory in social science*. New York: Harper.

Mar'i S. K. Karayanni, M. (1983). Creativity in Arab culture: Two decades of research. *Journal of Creative Behavior*, *16*, 227–238.

Mumford, M. D., Reiter-Palmon, R., & Redmond, M. R. (1994). Problem construction and cognition: Applying problem representations in ill-defined domains. In M. A. Runco (Ed.), *Problem finding, problem solving, and creativity* (pp. 3–39). Norwood, NJ: Ablex.

Nisbett, R., Peng, K., Choi, I., & Norenzayan, A. (2001). Culture and system of thoughts: Holistic versus analytic cognition. *Psychological Review*, *108*, 291–310.

Norenzayan, A., Smith, E. E., Kim, B., & Nisbett, R. E. (2002). Cultural preferences for formal versus intuitive reasoning. *Cognitive Science*, *26*, 653–684.

Paletz, S. B. F., & Peng, K. (2008). Implicit theories of creativity across cultures: Novelty and appropriateness in two product domains. *Journal of Cross-Cultural Creativity*, *39*, 286–302.

Paletz, S. B. F., Orasanu, J., Tada, Y., Fischer, U., & Kraft, N. (2006). [*Naive dialectical thinking in a sample of 96 second-generation Americans*]. Unpublished raw data.

Parker-Tapias, M., & Peng, K. (2001, August). *Locating cultures in the theory of planned behavior*. San Francisco, CA: Paper presented at the American Psychological Association's Annual Convention.

Peng, K., Ames, D., & Knowles, E. (2001). Culture and human inference: Perspectives from three traditions. In D. Matsumoto (Ed.), *Handbook of culture and psychology* (pp. 245–264). Oxford, UK: Oxford University Press.

Peng, K., & Nisbett, R. E. (1999). Culture, dialectics, and reasoning about contradiction. *American Psychologist*, *54*, 741–754.

Peng, K., & Nisbett, R. (2000). Dialectical responses to questions on dialectical thinking. *American Psychologist*, *55*, 1067–1068.

Peng, K., Spencer-Rodgers, J., & Zhong, N. (2006). Naive dialecticism and the Tao of Chinese thought. In U. Kim, K. S. Yang, & G. Huang (Eds.), *The handbook of indigenous and cultural psychology* (pp. 247–262). Boston: Blackwell.

Popper, K. (1972). *The logic of scientific discovery* (6th ed.). London: Hutchinson (Original work published 1959).

Reiter-Palmon, R., Mumford, M. D., & Threlfall, K. V. (1998). Solving everyday problems creatively: The role of problem construction and personality type. *Creativity Research Journal*, *11*, 187–197.

Reiter-Palmon, R., Mumford, M. D., O'Connor, Boes, J., & Runco, M. A. (1997). Problem construction and creativity: The role of ability, cue consistency and active processing. *Creativity Research Journal*, *10*, 9–23.

Riegel, K. F. (1973). Dialectical operations: The final period of cognitive development. *Human Development*, *18*, 430–443.

Rothenberg, A. (1994). Studies in the creative process: An empirical investigation. In J. M. Masling & R. F. Bornstein (Eds.), *Empirical perspectives on object relations theory* (pp. 195–245). Washington, DC: American Psychological Association.

Rothenberg, A. (1996). The Janusian process in scientific creativity. *Creativity Research Journal*, *9*, 207–231.

Rudowicz, E., & Hui, A. (1997). The creative personality: Hong Kong perspective. *Journal of Social Behavior & Personality*, *12*, 139–157.

Rudowicz, E., & Yue, X.-D. (2000). Concepts of creativity: Similarities and differences among mainland, Hong Kong, and Taiwanese Chinese. *Journal of Creative Behavior*, *34*, 175–192.

Runco, M. A. (1994a). *Problem finding, problem solving, and creativity*. Stamford, CT: Ablex.

Runco, M. A. (1994b). Creativity and its discontents. In M. P. Shaw & M. A. Runco (Eds.), *Creativity and affect* (pp. 102–123). Westport, CT: Ablex.

Runco, M. A. (1999). Tension, adaptability, and creativity. In S. W. Russ (Ed.), *Affect, creative experience and psychological adjustment* (pp. 165–194). Philadelphia: Taylor & Francis.

Runco, M. A., & Nemiro, J. (1994). Problem finding, creativity, and giftedness. *Roeper Review*, *16*, 235–241.

Schimmack, U., Oishi, S., & Diener, E. (2002). Cultural influences on the relation between pleasant emotions and unpleasant emotions: Asian dialectic philosophies or individualism–collectivism? *Cognition and Emotion*, *16*, 705–719.

Spencer-Rodgers, J., English, T., Boucher, H., Srivastava, S., Paletz, S., Hou, Y., et al. (2008). *The dialectical self scale*. Manuscript in preparation.

Spencer-Rodgers, J., Peng, K., Wang, L., & Hou, Y. (2004). Dialectical self-esteem and east–west differences in psychological well-being. *Personality and Social Psychology Bulletin*, *30*, 1416–1432.

Stein, M. I. (1953). Creativity and culture. *Journal of Psychology*, *36*, 311–322.

Torrance, E. P. (1962). Cultural discontinuities and the development of originality of thinking. *Exceptional Children*, *29*, 2–13.

Valacich, J. S., & Schwenk, C. (1995). Devil's advocate and dialectical inquiry effects on face-to-face and computer-mediated group decision making. *Organizational Behavior and Human Decision Processes*, *63*, 158–173.

Ward, T. B., Smith, S. M., & Finke, R. A. (1999). Creative cognition. In R. J. Sternberg (Ed.), *Handbook of creativity* (pp. 189–212). Cambridge, UK: Cambridge University Press.

Ward, T. B., Smith, S. M., & Vaid, J. (1997). *Creative thought: An investigation of conceptual structures and processes*. Washington, DC: American Psychological Association.