

THE ROLE OF CROSS-LINGUISTIC AND
CROSS-CULTURAL EXPERIENCES IN
BILINGUALS' DIVERGENT THINKING

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Abstract

Research addressing the possible consequences of bilingualism for individuals' creative abilities has revealed a contradiction between experimental findings of bilinguals' superiority in creative tasks and real life observations of no significant relationship between being bilingual and being creative. This chapter makes an attempt to resolve this contradiction and investigates a possible effect that bilingualism might have on creative abilities. Three factors in cross-linguistic and cross-cultural experiences of bilingual individuals are examined: language proficiency, age of second language acquisition, and experience and participation in two cultures. The empirical study with Russian-English bilingual immigrants living in the United States and English monolingual native speakers revealed that cross-linguistic factors in bilinguals' development had an influence on their divergent thinking abilities, which is a necessary component of creative thought. These findings suggest that although bilingualism may lay the foundation of creative thinking it does not necessarily imply being creative. To account for these findings, a cross-language transfer is proposed as a cognitive mechanism facilitating divergent thinking in bilinguals. A specific architecture of bilingual memory in which two lexicons are mutually linked to the shared conceptual system is theorized to facilitate the functioning of the cross-language transfer.

The present study contributes to creativity research by examining the effect of bilingualism on creative thinking. It will start out with a brief survey of existing literature on the relationship between bilingualism and creativity and discuss an apparent contradiction therein. Although it is suggested that bilinguals show greater performance on creativity tests, we do not see outbursts of creativity among nationals of bilingual countries. To account for this contradiction, the study will offer a perspective on the relationship between bilingualism and creativity, in which bilingualism facilitates divergent thinking. Divergent thinking is assumed as a necessary but not sufficient trait of creative behavior. Subsequently, it will present empirical findings indicating the factors in bilingual development that may contribute to bilinguals' superiority in divergent thinking. The following discussion will outline a model of bilingual memory, whose structure is suggested to facilitate cognitive processes underlying this trait. It will specifically

discuss the potential effect of bilinguals' cross-linguistic and cross-cultural experiences on their memory structure and interpret these effects within a proposed theoretical framework. The conclusion will point to the ways in which research with bilingual individuals may contribute to understanding the nature of divergent thinking and the cognitive ramifications of bilingualism.

1. THE RELATIONSHIPS BETWEEN BILINGUALISM AND CREATIVITY: ARE BILINGUALS TRULY CREATIVE?

Throughout the history of human civilization, numerous attempts to understand human creativity have been made. Interest in human creative capacity has never ceased and contemporary creativity researchers are still debating the nature of creativity¹. Is the capacity for creative thought limited to a certain class of gifted or especially talented people, or is this creative capacity an essential property of normative human cognition? The former view considers creative people as a minority capable of genuine creative thinking, and thus creativity has little bearing on the everyday cognitive activities of the general population. In this view, geniuses use cognitive processes that are radically different from those employed by most individuals in everyday problem solving. In contrast, the latter, creative cognition, approach argues that geniuses use the processes of normative human cognition (Ward et al. 1999). The "mundane" cognitive functioning goes beyond the everyday human capacities and satisfies the criteria of creative products: novelty and utility. However, there is no doubt about the existence of individual differences in creativity. Some individuals produce more creative outcomes than others, and a limited few achieve extreme levels of accomplishment (e.g., Simonton 1994; Eysenck 1995). Although the creative cognition approach admits these differences, they can be understood in terms of variations in the use of specifiable processes, and the richness and flexibility of stored cognitive structures to which the processes are applied (Ward et al. 1997).

The creative cognition approach is widely used in cognitive research on creativity. Most scientists converge on the notion that creative thinking is a complex process that may include problem definition and redefinition, divergent thinking, synthesis, reorganization, analysis, and evaluation (Getzels & Csikszentmihalyi 1976; Ochse 1990;

Lubart 1994, 2000; Sternberg & Lubart 1995; Sternberg 1999). Therefore, the focus of the creativity research is on the nature of these subprocesses and possible factors in individual development that may facilitate these subprocesses.

A particular interest of creativity researchers constitutes the possible contribution of bilingualism to creative thinking. In her seminal review paper Ricciardelli (1992b) reported 24 studies examining the relationship between bilingualism and creativity. Although the paper provides mixed findings, it shows a clear tendency for bilinguals to outperform their monolingual counterparts on various tests of creative thinking. Interpreting these results, one is tempted to draw a conclusion which assumes bilinguals' superior creative abilities. However, this assumption would be quite premature considering the real state of affairs in bilingual countries (e.g., Belgium, Canada, Switzerland). In spite of the fact that most nationals of these countries are bilingual, we do not find a higher level of creativity in these countries compared to monolingual countries. Rather, there seems to be no relationship between being bilingual and being creative.

Several possible explanations can account for the contradiction between empirical studies showing bilinguals' advantages in the creativity tests and real life observations showing no remarkable differences in creative performance between bilingual and monolingual individuals. First, most of the studies on the relationship between bilingualism and creativity were conducted with children (see Ricciardelli 1992b). Although these studies show an apparent gain of bilingual children over their monolingual counterparts, it is entirely possible that the superior creative abilities of the bilingual children do not persist into adulthood. Indeed, virtually the only study done with college students (Lemmon & Goggin 1989) shows no advantage for bilinguals on creativity tests.

Second, following example of Guilford and his colleagues (e.g., Christensen et al. 1960; Berger & Guilford 1969), most of the studies on the relationship between bilingualism and creativity use tests of divergent thinking (DT) as a measure of creativity (see Ricciardelli 1992b). The choice of this test has been supported by a large body of research, which provides evidence for the ability of DT tests to predict certain aspects of performance on creative problem-solving tasks

(e.g., Plucker & Renzulli 1999) and real-world creative achievement (e.g., Mumford et al. 1998). However, there is a meaningful argument that questions the validity of DT tests as a measure of creativity, because there was remarkably little evidence showing a strong correlation between highly creative people and high scores on the DT tests (Barron & Harrington 1981). For example, some researchers argue that the validity of DT tests may depend, in part, on the scoring procedures being applied (e.g., Runco & Mraz 1992). Others claim that DT tests are weakly related to other kinds of creativity ratings and therefore measure only a small portion of creativity (e.g., Hocevar 1981). Still others question the nature of DT tests as the measures of creativity at all. They argue that what the DT tests really measure are other types of cognitive abilities such as intelligence (e.g., Sternberg & O'Hara 1999). Thus, it is entirely possible that mundane cognitive processing, which the DT tests might measure, cannot predict eminent creative performance. In other words, although bilinguals outperform monolinguals in experimental studies, they do not show overall greater creative performance in real life.

Finally, note that in most of the studies on the relationship between bilingualism and creativity, bilingual groups included immigrants who, in addition to speaking two languages, were likely to experience and participate in two cultures². This cultural element has been virtually ignored in the study of the possible cognitive impact of bilingualism. However, it is likely that in addition to the virtue of speaking two languages, bilinguals who experience and participate in two cultures may benefit from the meta- and paralinguistic advantages of biculturalism leading to an increase in their creative abilities. As Peal and Lambert (1962) said over 40 years ago, a bilingual individual "whose wider experiences in two cultures have given him advantages which a monolingual does not enjoy. Intellectually his experience with two language systems seems to have left him with a mental flexibility, a superiority in concept formation, a more diversified set of mental abilities" (p. 20). Although this theme has been brought up in some other studies (e.g., Cummins & Gulutsan 1974; Okoh 1980; Francis 2000), it has not received enough attention in the empirical research. Therefore, another plausible explanation for the observation that the nationals of bilingual countries do not show exceptional creative performance can be traced to

the fact that these individuals have acquired their languages in primarily monocultural environment of the respective countries (e.g., Belgium, Canada, and Switzerland). Thus, they cannot benefit from the potential cognitive advantages of the cross-cultural experience. More generally, it is entirely possible that the inconsistency in the findings in research on cognitive impacts of bilingualism can be explained by a failure to have controlled for this factor.

Altogether, there is an obvious discrepancy between the observation of no remarkable differences between bilinguals' and monolinguals' creative performance in real life and the finding of significantly superior performance of bilinguals on creativity tests in laboratory settings. In view of proposed explanations, although bilingualism might have an influence on creativity, this influence seems to be indirect. That is, bilingualism may encourage the use of certain cognitive processes in a more efficient way, which paves the way for more sophisticated cognitive processing. The latter may result in creative production in some individuals, but other factors in their development (e.g., intelligence, education, motivation, personal experience) may play a more dominant role.

2. WHY MIGHT BILINGUALS HAVE ADVANTAGES IN DIVERGENT THINKING PERFORMANCE?

This chapter argues that bilingualism³ might contribute to individuals' creative abilities, but its contribution is likely to be limited to an increase in divergent thinking. This argument stems from the notion that bilinguals show greater cognitive abilities compared to their monolingual counterparts. Although bilingualism researchers are still debating as to whether the ability to speak more than one language is beneficial or detrimental to an individual's cognitive development (see Cook 1997 for an overview), a growing number of empirical studies (e.g., Peal & Lambert 1962; Ricciardelli 1992a; Bialystok et al. 2004, 2005) show that speaking two languages extends rather than diminishes the individual's cognitive capacities. In addition, following the creative cognition approach (Ward et al. 1999), creativity can be explained by enhanced normative cognition. If bilingualism results in more elaborate cognitive

structures and/or functioning, then it follows that it should also facilitate creativity.

Having stated this, the next question is what cognitive processes might underlie creative thinking. During the past 50 years, a large number of studies have explored the nature of the processes involved in creativity, and a large class of models was proposed to describe these processes. Most of these models seem to converge on the mechanism of the simultaneous activation of different, often unrelated, concepts or categories that creates a new plane on which the original and novel ideas might be established. For example, Rothenberg (1996) describes Janusian thinking as ability for “actively conceiving multiple opposites or antitheses simultaneously” (p. 207). This concept is similar to another of Rothenberg’s (1979) ideas, that of homospatial thinking, which “consists of actively conceiving two or more discrete entities occupying the same space, a conception leading to the articulation of new identities” (p. 7). Similarly, Koestler (1968) introduces the concept of bisociation, which he defines as an ability for “combining two hitherto unrelated cognitive matrices in such a way that a new level is added to the hierarchy, which contains the previously separate structures as its members” (p. 183). Another model talks about remote associations, the ability of creative individuals to build connections between unrelated ideas or objects (Mednick 1962).

Although these models are relatively fuzzy and provide no clear description of the subprocesses underlying creative thinking, they all seem to emphasize the important property of creative thought, the ability to establish distant associations that link concepts from distant categories. This communication between concepts is assumed to be an unconscious process during which activation is propagated throughout the conceptual network. These subprocesses resemble the kind of divergent thinking that involves a broad search for information, establishing distant associations that link concepts from distant categories and the generation of numerous novel alternative answers to problems (Guilford 1967). Guilford saw divergent thinking ability as a major component of creativity and associated it with four main characteristics: fluency (the ability to rapidly produce a large number of ideas or solutions to a problem); flexibility (the capacity to consider a variety

of approaches to a problem simultaneously); elaboration (the ability to think through the details of an idea and carry it out); and originality (the tendency to produce ideas different from those of most other people). He contrasted divergent thinking with convergent thinking – the ability to narrow all possible alternatives down to a single solution. Both divergent and convergent thinking are necessary subprocesses that result in creative performance. Therefore, creative thinking is assumed to be an ability to initiate multiple cycles of divergent and convergent thinking, creating an active, attention-demanding process that allows generation of new, alternative solutions (Mumford et al. 1991).

Thus, although divergent thinking is identified as one of the major components of creativity (Guilford 1967), other processes (e.g., synthesis, reorganization, analysis, and evaluation) may be the essential contributors to eminent creative performance. This study argues that although bilingualism might contribute to an increase in creative abilities, its contribution is limited to divergent thinking. The next section discusses three factors in bilinguals' development (proficiency in both languages, age of acquisition of these languages, and experience with cultural settings in which these languages are learned) that are hypothesized to facilitate their divergent thinking abilities. However, other factors in individual development (e.g., intelligence, education, motivation, and personal experience) not accounted for by bilingualism may be necessary components for the ultimate creative production. The inability to develop these factors to a greater extent may prevent bilinguals from showing superior creative performance.

3. WHAT FACTORS IN BILINGUALS' DEVELOPMENT MIGHT INFLUENCE THEIR DIVERGENT THINKING?

A large body of bilingualism research shows that bilinguals' proficiency in two languages and age of acquisition of these languages (both assumed as cross-linguistic experience) as well as participation and experience with two cultures in which these languages are acquired (assumed as cross-cultural experience) have an impact on their cognitive development.

A number of empirical studies suggest that bilinguals' proficiency in both languages can be a reliable predictor of their cognitive abilities (e.g., Cummins 1976; Lemmon & Goggin 1989; Ricciardelli 1992a). Similarly, studies with bilingual children show that the age of second language (L2) acquisition can be an essential contributor to bilingual children's cognitive development (see Swain & Lapkin 1982). Therefore, bilinguals' cross-linguistic experience may be an important factor facilitating their cognitive capacities that may result in an increase in divergent thinking. The repeated switching from one language to another and constantly dealing with two code systems (phonological, grammatical, and lexical) may facilitate their dual linguistic perspective (Lambert 1977). This may account for bilinguals' greater metalinguistic awareness, which presumably facilitates their cognitive flexibility (Ianco-Worrall 1972; Bialystok 1988).

Furthermore, as contemporary research on conceptual representations in bilingual memory shows, bilinguals may undergo conceptual changes due to experience within different cultural and linguistic environments (e.g., de Groot 2000; Paradis 2000; Pavlenko 2000). These researchers argue that the conceptual system of individuals who acquire more than one language inevitably undergoes adaptations that are influenced by the cultural and social contexts in which these languages were learned. Cultural knowledge (in the form of schemas and frames) modifies conceptual representations and organizations in bilingual memory (Vaid 2000). New connotations, even entirely new meanings, may develop through acculturation.

Thus, experience with two different cultures may cause modifications in the bilingual conceptual system that reflects cross-cultural diversity in conceptual representations. De Groot (2000) illustrates this with the example of a turkey. The conceptual features of TURKEY in non-North American culture-specific conceptual systems have no associations with great festivities taking place only in North America. However, for newcomers to North America, the concept THANKSGIVING develops over a series of Thanksgiving experiences and includes turkey as an attribute of the festival. As a result, a conceptual representation of a turkey may change over time as a function of experience with the L2 culture. In particular, the conceptual representation of a turkey

may become extended once it includes additional celebration-related features.

In turn, newly developed conceptual representations may allow bilinguals to see the same phenomenon from different perspectives. As a number of scholars suggest, bilingual individuals who experience and participate in two cultures may well perceive the world through the amalgam of two different conceptual prisms and view events with a wider range of enriched experiences (e.g., Cummins & Gulutsan 1974; Okoh 1980). These enhanced conceptual representations may promote cognitive flexibility, divergent thinking, and novel and creative ways of encoding experience.

In addition, since different cultural commonalities may provide different perspectives on the same phenomena (Ricciardelli 1992b), bilinguals "may have a greater tolerance for ambiguity because they are comfortable with situations in which one basic idea may have different nuances" (Lubart 1999, p. 344). Tolerance of ambiguity, in turn, is considered a valuable trait of divergent thinking, because unrelated, often contradicting elements coexist during this process.

Finally, both cross-linguistic and cross-cultural experiences may result in modifications in the structure of bilingual memory. The specific structure of bilingual memory may account for bilinguals' "greater diversity of associations to the same concept because it is situated in two different linguistic conceptual networks" (Lubart 1999, p. 344). The diversity of associations is assumed as a key property of divergent thinking, which implies the ability to link unrelated concepts from different categories.

Altogether, bilinguals' cross-linguistic and cross-cultural experiences seem to facilitate cognitive flexibility, tolerance of ambiguity, and diversity of association. These cognitive processes may foster simultaneous activation and elaboration of a multitude of often unrelated concepts, that is, divergent thinking.

The following section presents an empirical study in which the relationship between bilingualism and divergent thinking is examined. Three factors in bilingual development (language proficiency, age of L2 acquisition, and rate of cross-cultural experience) are considered as potential contributors to the increase in bilinguals' performance on

DT tasks. Based on the findings of this study a theoretical framework is proposed in which the specific structure of bilingual memory is argued to facilitate cognitive processes that might result in an increase in divergent thinking abilities.

4. EMPIRICAL EVIDENCE OF BILINGUALS' PERFORMANCE ON DT TASK

Several hypotheses were tested in this study. First, bilingualism has an influence on divergent thinking, which should be manifested in superior performance of bilingual participants over their monolingual counterparts on the DT tasks. Second, cross-linguistic and cross-cultural experiences influence bilinguals' divergent thinking. It was expected that the degree of language proficiency in both languages, the age of acquisition of both languages, and the rate of experience with both cultures in which bilinguals' languages were acquired would have an effect on bilinguals' performance on DT tasks.

4.1. Participants

The participants were Brooklyn College psychology students who participated for course credit. One hundred and three immigrants from the former Soviet Union living in the US who claimed to speak Russian and English (25 male and 78 female) aged between 16 and 39 ($M = 21.57$, $SD = 4.63$) were selected for the experiment. All participants indicated that Russian was their L1. They also reported to have various degrees of experience with Russian and North American cultures. In addition, 52 American participants who reported being native monolingual English speakers (21 male and 31 female) aged between 16 and 51 ($M = 23.15$, $SD = 8.58$) were selected for the study.

4.2. Materials and Assessment Techniques

Divergent thinking abilities were assessed with the standard procedure in the field, the Abbreviated Torrance Test for Adults (ATTA, Goff & Torrance 2002), which measures verbal and non-verbal fluency (the total number of relevant responses), flexibility (the number of different categories of relevant responses), elaboration (the amount of detail in

the responses), and originality (the statistical rarity of responses). The standard ATTA assessment consisted of four norm-referenced abilities (fluency, flexibility, elaboration, and originality). Several procedures were used to assess cross-linguistic and cross-cultural experiences in bilingual participants. The age of acquisition of both languages was obtained from a background questionnaire.

Language proficiency in English and Russian was assessed using a modified version of the Picture Naming Test (PNT), in which participants' knowledge of each of these languages was evaluated by the accuracy of participants' responses to 120 pictures of simple objects, a technique similar to that used by Lemmon and Goggin (1989). These pictures, randomly selected from those scaled by Rossion and Pourtois (2001), a revised version of Snodgrass and Vanderwart (1980), were arranged in a booklet with each page containing 30 pictures. Participants had two minutes to provide the names for all 30 pictures on each page. Each response was scored either 1 or 0, so that the maximum number of points for picture naming in either language was 120. A list of appropriate labels in English and Russian was generated for each picture by two independent native speakers for each language. If the participants' label matched the corresponding item on the list, they scored 1 point, otherwise, 0 points. A composite PNT score was computed as the sum of participants' performance on the English and Russian PNT with a higher score indicating greater proficiency in both languages.

The cross-cultural experience was assessed by the cultural exposure coefficient (CEC), which was computed by dividing the absolute value of the difference between the number of years a participant lived in Russia (obtained from the age of immigration) and the number of years he or she lived in the US (obtained from the length of residence in the US) by the participant's age⁴. This coefficient is similar to an index previously used by Tropp et al. (1999). Smaller coefficient values represent the more balanced individuals' cultural exposure, with 0 representing equal exposure to both cultures. Larger values represent those with a less balanced cultural exposure, with 1 representing monocultural individuals. In the same fashion, participants who were exposed to a new culture earlier had a greater CEC value than those who were exposed to a new culture later in life.

Altogether, each bilingual participant had three developmental scores: age of L2 acquisition, composite PNT, and CEC.

4.3. Results

An ANOVA was performed with four norm-referenced DT measures (fluency, flexibility, elaboration, and originality) as dependent variables and language group (monolingual vs. bilingual) as an independent variable. The analysis showed that bilingual participants outperformed their monolingual counterparts on the ATTA measures of fluency ($F(1, 154) = 7.61, p < .01$), flexibility ($F(1, 154) = 5.96, p < .05$), and elaboration ($F(1, 154) = 2.16, p = .14$), but there was no significant difference in their performance on the measure of originality (see Figure 1). This finding indicates that bilingualism has an impact on the ability to rapidly produce a large number of ideas or solutions to a problem (fluency), the capacity to consider a variety of approaches to a problem simultaneously (flexibility), and to think through the details of an idea and carry it out (elaboration). However, it does not have an effect on the tendency to produce ideas different from those of most other people (originality).

Furthermore, a multiple regression analysis was applied to the data from the bilingual group to determine whether there was a direct relationship between the factors in the cross-linguistic and cross-cultural experiences and the four traits of divergent thinking. Standard multiple regressions were performed between the composite PNT score, age of L2 acquisition, and CEC as independent variables and ATTA measures of fluency, flexibility, elaboration, and originality as the respective dependent variables. The analysis revealed that the age of L2 acquisition contributed significantly to prediction of bilinguals' fluency and flexibility scores ($\beta = -.26, p < .01$ and $\beta = -.24, p < .05$, respectively). The negative correlation indicates that bilinguals who acquired L2 earlier in life tended to show greater fluency and flexibility in divergent thinking. In addition, it was found that the composite PNT score contributed significantly to prediction of participants' elaboration score ($\beta = .28, p < .01$). The positive correlation indicates that bilinguals who were more proficient in both languages tended to show greater elaboration

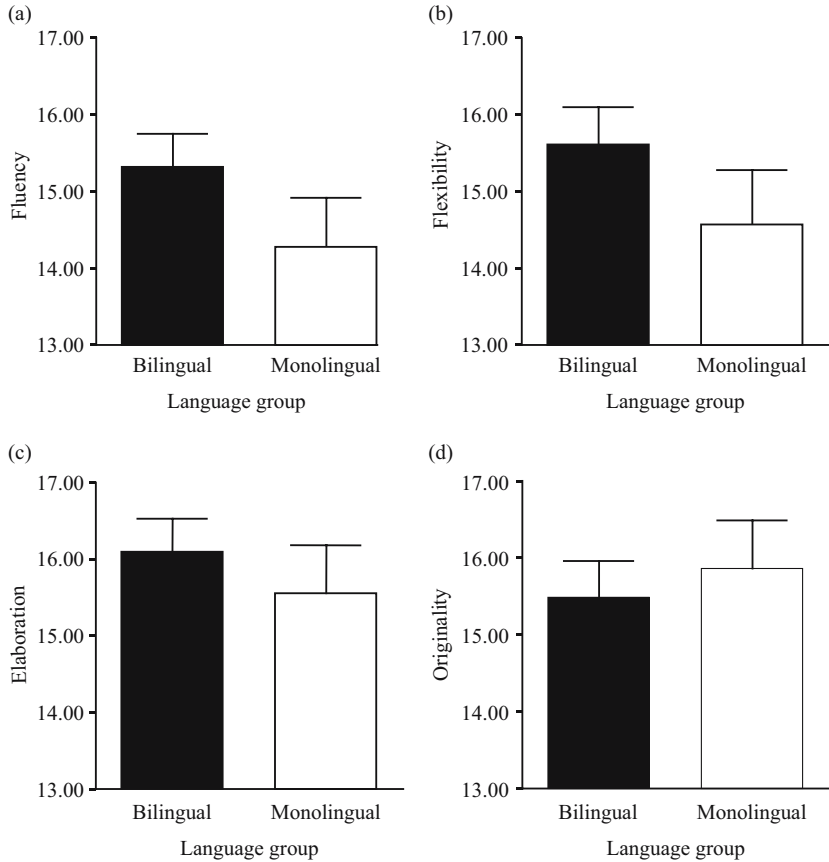


Figure 1. Bilingual and monolingual groups' performance on the ATTA measures of (a) fluency, (b) flexibility, (c) elaboration, and (d) originality with error bars representing 95% confidence interval ($N = 155$).

in divergent thinking. The CEC revealed no significant correlation with any DT measure.

Altogether, the findings suggest that at least two factors in bilingual development might have an impact on divergent thinking abilities. Extensive cross-linguistic experience, as evidenced by early L2 acquisition and high proficiency in both languages, tends to be positively

related to bilinguals' performance on the divergent thinking traits that require simultaneous activation of a large number of concepts from different categories and the ability to keep them active during the thought process.

4.4. Bilingual \neq Creative

The findings of the study show that bilingualism has an effect on the fluency, flexibility, and elaboration in divergent thinking, but has no influence on the originality trait. Note that the first three measures of the ATTA (fluency, flexibility, and elaboration) test the ability to rapidly produce a large number of ideas or solutions to a problem, the capacity to consider a variety of approaches to a problem simultaneously, and the ability to think through the details of an idea and carry it out. In other words, they require the ability to activate a multitude of unrelated concepts from different categories and work through concepts already activated. In contrast, the last ATTA measure (originality) probes the tendency to produce ideas different from those of most other people. This ability to generate novel and unique ideas seems to account for the divergent thinking trait that may directly contribute to genuine creativity.

Logically, these four traits of divergent thinking are grouped together as two types of creative behavior: the ability to generate and to elaborate on various, often unrelated, ideas and the ability to extract novel and unique ideas. The first type seems to represent characteristics of the preparation stage of the creative process, that is, the ability to activate a multitude of unrelated concepts and work through concepts already activated. However, it does not imply that the ideas based on these concepts should necessarily be original (i.e., satisfy the criteria of novelty) and result in creative production. On the other hand, the second type of creative behavior accounts for originality in thinking, that is, the ability to produce innovative and useful ideas. This type therefore accounts for the finalizing stage of the creative process. This study assumes that the functions of the first category are basic cognitive processing (similar to early cycle capacity in Mumford 2000) that, according to the creative cognition approach (see Ward et al. 1999), paves the way for

more sophisticated cognitive processing (similar to Mumford's late cycle capacity) during which the original ideas may be extracted. Although these two types of processing were seen as distinct cognitive capacities (e.g., Guilford 1950), one might argue that the rate of idea generation during the first stage should provide a larger pool of ideas to work with thereby contributing to the production of more original outcomes (Simonton 1998). However, other individual cognitive capacities (e.g., intelligence, education, motivation, and personal experience) might play a dominant role here.

In other words, the findings support the notion that although bilingualism might have an influence on creativity, it is rather indirect. Bilingualism may encourage the use of certain cognitive processes in a more efficient way, which paves the way for more sophisticated cognitive processing. The latter, in turn, may result in creative production in some individuals, but other factors in their development may override the effects of bilingual development. Thus, if bilingualism has any contribution to the increase in creative abilities, its possible function is to facilitate the basic cognitive processes responsible for generating a multitude of unrelated ideas and to work through the ideas already generated; that is, it encourages certain cognitive processes that might be responsible for an increase in simultaneous activation and processing of a large number of unrelated concepts.

The limited contribution of bilingualism to creative thinking provides an explanation for the contradiction between superior bilinguals' performance on the creativity tests in the laboratory settings and no systematic difference in bilinguals' and monolinguals' performance in real life. Most of the creativity tests employed in the studies on bilingualism and creativity (see Ricciardelli 1992b) probed the skills needed to activate conceptual representations simultaneously and produce multiple solutions to a problem, but not an ability to extract original solutions out of this multitude. Bilinguals seem to have some predisposition for creativity, but this predisposition must be supported by other factors in individual development (such as intelligence, education, motivation, personal experience, etc.) not related to bilingualism itself. Therefore, the fact that an individual speaks more than one language does not imply that he or she should be creative.

4.5. *Bilingual Developmental Factors Influencing Divergent Thinking*

This study also shows that cross-linguistic experience has a positive effect on bilinguals' divergent thinking performance. In contrast, cross-cultural experience reveals no significant effect on this ability. The following subsections present a detailed discussion of the effects of the age of L2 acquisition and language proficiency on bilinguals' divergent thinking abilities. They are followed by somewhat speculative explanations for the finding of no effect of the cross-cultural experience on divergent thinking.

4.5.1. The effect of the age of L2 acquisition on divergent thinking The data above provides evidence that the age at which L2 was acquired relates to the ability to establish links between unrelated concepts from distant categories (fluency and flexibility in divergent thinking). The negative correlation indicates that individuals who acquired L2 at a younger age show greater divergent thinking abilities. This finding corresponds with the reports of bilingual children's performance in the immersion programs (Swain & Lapkin 1982). A number of studies conducted in the 1970s with students in an early French immersion program in Toronto and Ottawa (Canada) showed that the age of entering the program could be an essential factor in bilingual children's cognitive development. In the same fashion, other studies reported an age-related decline in encoding new information (Craik & Jennings 1992) and decrease in working memory capacity (Kharkhurin et al. 2001), cognitive processing speed, and attention (Kemper 1992).

A possible explanation for these findings could be the notion that the changes in bilingual memory modulated by early acquisition of both languages may result in certain cognitive advantages. As predicted by Lenneberg's (1967) critical period hypothesis, if L2 acquisition occurs before the age of puberty, it will be relatively fast, successful and qualitatively similar to first language (L1). He relates these advantages to the fact that language learning occurs before lateralization is complete. The brain at an early age is still flexible and therefore allows more detailed analysis of incoming linguistic information, which may result in a greater level of attainment in language acquisition (see Newport 1990, "less is

more" hypothesis, for a similar view). Later on, as the person matures and learns various cognitive strategies, this early advantage may be lost. The studies with connectionist networks provide evidence for the maturation hypothesis. For example, Elman (1993) demonstrated that the training of a recurrent connectionist network with complex grammatical rules fails if the model is fully formed and equipped with adult-like capacity from the onset. However, learning is successful if the model initially has a restricted child-like capacity that gradually matures into an adult-like one.

4.5.2. The effect of language proficiency on divergent thinking The results of the present study also show that language proficiency in both English and Russian positively correlates with the ability to keep concepts active during the thought process (elaboration in divergent thinking). This indicates that bilinguals with high proficiency in both languages are more successful in concept processing than their less proficient counterparts. This finding is in line with a number of studies on children showing proficient bilinguals' superiority on various DT tasks (e.g., Ricciardelli 1992a). These studies converge on the idea formulated in the threshold theory (Cummins 1976) arguing that bilinguals need to achieve high levels of linguistic proficiency in both of their languages before bilingualism can promote cognitive advantages. For example, Ricciardelli tested this theory with Italian-English bilingual and English monolingual children. She found that only bilingual children highly proficient in both Italian and English showed superior divergent thinking abilities. Those bilinguals who had low proficiency in either one or both languages did not show any significant difference from the monolinguals.

4.5.3. The effect of cross-cultural experience on divergent thinking In addition to the influence of the cross-linguistic experience on divergent thinking, a possible impact of cross-cultural experience was examined. It was hypothesized that the experience and participation in two cultures that often accompany language acquisition may have a facilitating effect on the development of bilinguals' conceptual system, which in turn may encourage divergent thinking. The obtained results, however, failed to support this hypothesis: there was no significant correlation between

the degree of cross-cultural experience (as assessed by the CEC) and bilinguals' divergent thinking performance. The most obvious interpretation of this finding is that cross-cultural experience is not related to divergent thinking abilities at all. However, for the sake of potential development for the bilingualism/biculturalism research, it is plausible to consider this issue in more detail. Several alternative, although not necessarily mutually exclusive, explanations can be advanced for the finding of no significant correlation between the cross-cultural experience and divergent thinking.

4.6. The CEC is Not a Sensitive Measure of Cross Cultural Experience

First, the CEC used in this study as a measure of cross-cultural experience could be insensitive to variations in the cross-cultural environment and its psychological ramifications that might have an influence on individuals' divergent thinking. It is a well known problem in the psychological research on biculturalism: cross-cultural experience is not only extremely difficult to define, but even more difficult to measure and relate to the individual's cognitive functioning (Francis 2000). Although the CEC has some redeeming features, it seems to be somewhat simplistic in that mere exposure to a culture does not necessarily reflect the psychological implications of that exposure. For example, as Tropp et al. (1999) noted, some individuals may live in the US throughout their lives without feeling a strong connection to it and may, in turn, be less likely to embrace North American cultural norms and expectations. Conversely, some recent immigrants may identify strongly with the prevailing US norms and standards and may therefore attempt to integrate aspects of North American culture into their daily lives. Therefore, it might be plausible for future research to introduce a more sensitive measure of cross-cultural exposure that reflects the psychological ramifications of the bicultural experience.

4.7. Bicultural Experience is Subcultural in Fact

If there is indeed a relationship between the degree of cross-cultural experience and individuals' cognitive and divergent thinking abilities,

the specificity of cultural experience of participants in this study may have prevented them from showing this effect. A number of studies argue that bilinguals undergo conceptual changes due to experience within different cultural and linguistic environments (e.g., de Groot 2000; Kecskes & Papp 2000; Pavlenko 2000). Kecskes (2003; in this volume) hypothesized that in the mind of bi- and multilingual speakers there are synergic concepts that are the results of conceptual blending. According to his definition "synergic concepts are a group of concepts that are lexicalised in both languages but have a different socio-cultural load in each language."

The present study hypothesizes that these conceptual changes may result in increased cognitive flexibility and divergent thinking abilities due to, for example, the internalization of new concepts and convergence and restructuring of these concepts. This hypothesis was based on the assumption that bicultural individuals acquire the values and norms of the new as well as the original culture. In the "turkey" example presented above, the conceptual representation of a turkey may expand since it includes additional features related to the experience of celebration. The expanded conceptual system was supposed to facilitate individuals' perception of a variety of events from different culture-specific perspectives, and therefore to increase their cognitive flexibility and divergent thinking abilities.

However, it is entirely possible that the participants in this study who were assumed to have a bicultural experience had in fact a subcultural one⁵. That is, they might have developed perspectives that were distanced from the source culture and yet differed from the culture of the country of their current residence (Ervin-Tripp 2000). Due to a variety of negative effects that were found to accompany the process of acculturation (see Birman & Trickett 2001), the subcultural experience could result in the attrition of the essential knowledge of the original country, and at the same time the inability to fully acquire the knowledge of a new culture. In other words, it could be speculated that due to the subcultural experience, participants in this study underwent those conceptual changes that resulted in a poorly developed conceptual system. This notion is supported by Pavlenko's (2000) model of conceptual development, in which the interaction of two languages and cultures

may result in conceptual changes that may include the internalization of new concepts, convergence of the concepts and restructuring, but at the same time, attrition and/or substitution of previously learned concepts by new ones and a shift from one conceptual domain to another. The conceptual changes of the latter types could result in the inability of bilingual participants in this study to develop their conceptual system to a greater extent. This, in turn, could eliminate any significant correlation between their cross-cultural experience and divergent thinking performance. Therefore, future research should control for the history of acculturation of bilingual individuals, namely for the sociocultural environment in which they reside.

4.8. The Limitations of Cross-Cultural Differences in this Study

Finally, it is entirely possible that certain aspects of North American and Russian cultures are too similar to initiate remarkable conceptual changes that may result in an increase in divergent thinking. Both of these cultures have their roots in Western civilization. Therefore, there might be too few fundamental distinctions in the North American and Russian cultural settings to develop alternative perspectives on the same phenomena. Thus, it might be reasonable for the future research to consider more distant cultures that developed in completely different traditions (e.g., Western and Eastern).

5. BILINGUAL MEMORY MODEL

This study demonstrates bilinguals' superiority over monolinguals in fluency, flexibility, and elaboration in divergent thinking. These traits represent the ability to activate a multitude of unrelated concepts from different categories and work through concepts already activated. This study also shows that bilinguals' extensive experience with two languages facilitates this ability. To account for these findings, this chapter presents a theoretical framework in which the increase in divergent thinking results from enhanced spreading activation between conceptual and lexical representations in bilingual memory. In this framework, bilinguals' proficiency in both languages and their age of acquisition

of these languages are theorized to modify the structure of bilingual memory. Modified bilingual memory may subsequently facilitate bilinguals' superiority in divergent thinking performance.

5.1. *The Structure of Bilingual Memory*

One of the central issues in psycholinguistic studies of bilingual memory evolves around the levels of representation of bilinguals' languages and their underlying concepts (see Kroll & Tokowicz 2005 for an overview). The present study employs the distributed lexical/conceptual feature model (see Kroll & de Groot 1997 for a detailed description of the model) to explain the facilitation effect of the specific structure of bilingual memory on divergent thinking. The model consists of a language independent (shared) conceptual feature level, a language non-specific (shared) lexical feature level, and a language specific lemma level that mediates between activation of lexical and conceptual features. Thus, this chapter assumes that bilingual memory is a dynamic system with three levels of representation: a conceptual features level that consists of representations of meaning, a lexical features level that does not include word meanings, but only aspects of word form, and a language specific lexical-semantic level that mediates the word forms and their meanings. The spreading activation is seen as a communication mechanism between all three levels. The conceptual features level contains distributed conceptual features, the lexical-semantic level contains language specific lemmas, and the lexical features level contains distributed lexical features (aspects of word form)⁶. Note that throughout the following discussion, the terms *lexicon* and *lexical* refer to the lexical-semantic system, which consists of language specific units and more generally to bilinguals' two languages, whereas the term *lexical features* refers to specific lexical features system that contains only the aspects of word form.

5.2. *Association Routes in Bilingual Memory*

Several assumptions pertinent to the discussion of cognitive mechanisms facilitating divergent thinking in bilinguals follow from the proposed model of bilingual memory. As mentioned above, divergent thinking refers to the ability to activate and simultaneously process a large number

of unrelated ideas and access concepts from distant categories (Guilford 1967). This property of divergent thinking may benefit from a greater diversity of associations to the same concept (Lubart 1999). This study suggests that bilinguals' ability to activate a larger span of associations compared to their monolingual counterparts can be explained by the functioning of the spreading activation mechanism. This mechanism may assist bilinguals in simultaneously activating a set of unrelated concepts to a greater extent than monolinguals are able to activate them. The distributed nature of bilingual memory may facilitate the dispersion of activation throughout the conceptual network.

Intuitively speaking, associations in monolingual memory can be established due to the distributed nature of the conceptual system. The same conceptual features may be a part of the representation of different concepts. For example, the concept CAT shares a set of conceptual features with the concept DOG (e.g., "4 paws," "tail," "animal," etc.). The activation of the conceptual representation of a dog may result in a partial activation of the conceptual representation of a cat, as shown in semantic priming studies (e.g., Meyer & Schvaneveldt 1971). These two concepts however, differ in some essential features that are unique for each (e.g., the "bark" feature for the DOG, and the "meow" feature for the CAT). Due to the distributed nature of conceptual system, these features can activate other conceptual representations (e.g., the "bark" feature can send partial activation to the conceptual representation of a fox) and additional associations can be formed. However, the activated concepts are likely to be members of the same or similar categories (as the concepts DOG and FOX in the previous example are the members of a category [animal]). Only people with exceptional associative thinking abilities may relate concepts that lie beyond the category boundaries. Various factors in individuals' development (such as intelligence, education, personal experience, etc.) may stimulate this processing.

Associative thinking is an inherent property of both bilingual and monolingual conceptual memory. However, in addition to an ingenious capacity to form associations due to the distributed nature of the conceptual network, bilinguals may benefit from structural and/or procedural changes in their memory, which result from cross-linguistic

and cross-cultural factors in their development. The modified bilingual memory is theorized to permit broad language-mediated concept activation. That is, activation flow on the conceptual level, mediated by the lexical level, establishes the links between more distant conceptual units that cannot be readily activated in the monolingual conceptual network. The activation of distant concepts in turn may result in launching more distant associations, the process underlying divergent thinking.

6. LEMMA AND WORD FORM MEDIATED CROSS-LANGUAGE TRANSFER

This chapter proposes that experience with two languages may enhance the lexical-conceptual routes in bilingual memory, which facilitates *cross-language transfer*. The latter occurs due to the mutual activation of language units representing translation equivalents in bilinguals' languages. Cross-language transfer may assist the spreading activation in the conceptual network and therefore result in a greater span of associations in the bilingual conceptual system compared to the monolingual one. Kecskes and Papp (2000) spoke about a similar phenomenon that they called "bidirectional transfer."

The notion of cross-language transfer is based on the theory that communication between translation equivalents in bilinguals' languages is concept mediated (see Kroll & de Groot 1997, for a discussion). Following the concept-mediated model, the translation equivalents in L1 and L2 lexicons activate each other through the corresponding conceptual units. For example, the word "cat" in English and its German translation "die Katze" share the same set of conceptual units (such as "4 paws," "a tail," "an animal," "a meow," etc.) that mediate between lexical units in these two lexicons. A bilingual variant of primed lexical decision tasks supports this notion by showing that semantically related words in different languages prime each other (e.g., Zeelenberg & Pecher 2003; Kroll & Tokowicz 2005).

The present study goes one step further and suggests that once activated, these lexical units may send partial activation to the conceptual representations of objects, events, etc. that are lexically related to

the given ones. In the framework of the distributed lexical/conceptual feature model, this activation can take place on two levels of processing: the lexical-semantic level, on which conceptual representations sharing the same lemmas can be activated (e.g., the figurative meaning of the word “cat” as in “cat burglar” in English, or the figurative meaning of the word “*Katze*” as in “*die Katze im Sack kaufen*” /to buy a pig in a poke/ in German); and the lexical features level, on which conceptual representations sharing the same word forms can be activated (e.g., “marker” in English and “*marka*” /stamp/ in Russian).

6.1. Lemma-Mediated Activation

The lemma-mediated activation is believed to work as follows. A word in L1 activates corresponding lemmas in the L1 lexicon, which in turn, activate the corresponding conceptual features. The conceptual features send partial activation back to the L2 lexicon, which activates the corresponding L2 lemmas. These lemmas, once activated, may send partial activation to the conceptual features representing concepts that share this lemma with the target word.

In the *cat/Katze* example, the presentation of the English word “cat” to English-German bilinguals activates a lemma {cat} in the English lexicon (see Figure 2). This lemma in turn sends activation to conceptual features that represent the literal meaning of a cat; additionally, it may send a partial activation to the conceptual representation of the alternative meaning of the lemma {cat} such as the one in the “cat burglar.” Thus, the conceptual representation of BURGLAR is activated.

At the same time, the conceptual representation of a cat sends partial activation back to the lemma level in the German lexicon thereby activating the lemma {*Katze*}. This lemma, once activated, may in turn send partial activation to the conceptual representation of the additional meaning of the lemma {*Katze*} such as the one in “*die Katze im Sack kaufen*.” Accordingly, the latter may send partial activation back to the lemma level in the English lexicon thereby activating a set of lemmas corresponding to the idiom “to buy a pig in a poke,” an English translation equivalent to the German expression. Therefore, among the others, the lemma {pig} is activated and in turn triggers its corresponding conceptual features. As a result, a large pattern of conceptual representations is activated that allows simultaneous exploration of unrelated concepts

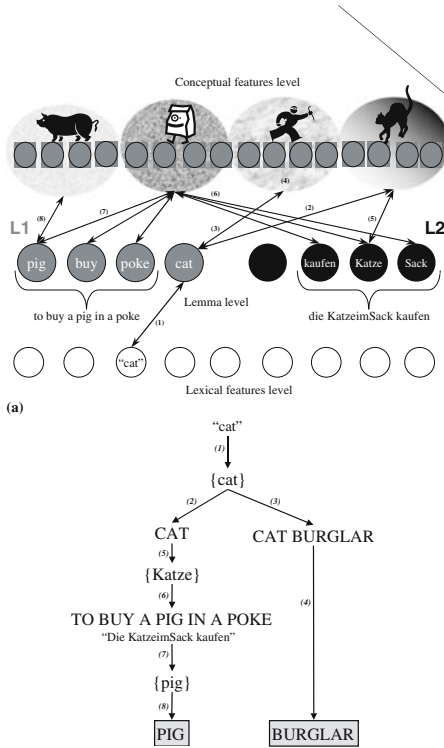


Figure 2. Illustration of a lemma mediated spreading activation underlying cross-language transfer. Schematic representation of (a) a fragment of bilingual memory structure, and (b) the information flow in bilingual memory. Bilingual memory consists of the distributed lexical features level, language specific lemma level, and distributed conceptual features level. The presentation of the English word “cat” activates a lemma cat in the English lexicon (1) This lemma in turn activates conceptual features that represent the literal meaning of a cat (2) as well as the conceptual representation of the additional meaning of the lemma cat such as the one in the “cat burglar” (3) Thereby the conceptual representation of BURGLAR is activated (4) At the same time, the conceptual representation of a cat sends partial activation back to the lemma level in German lexicon thereby activating a lemma Katze (5) This lemma sends partial activation to the conceptual representation of the additional meaning of the lemma Katze such as the one in “die Katze im Sack kaufen” (6) Accordingly, the latter sends partial activation back to the lemma level in English lexicon thereby activating a set of lemmas corresponding to the idiom “to buy a pig in a poke.” Therefore, among the others, a lemma pig is activated (7) and in turn, triggers its corresponding conceptual features (8).

(such as BURGLAR and PIG) from distant categories (such as [crime] and [animal]). It is important to note, however, that this schema is rather speculative and requires empirical investigation.

6.2. *Word Form-Mediated Activation*

Furthermore, this study proposes that lemma-mediated cross-language transfer is facilitated by lexical features level activation. Words that share the same word forms (e.g., orthographic, phonological) may activate each other in the same way that words with similar lexical properties activate each other in the monolingual memory (e.g., Allopenna et al. 1998). This assumption was inspired by the findings of eye-tracking studies showing that cross-linguistic homophones tend to activate each other (e.g., Marian & Spivey 2003). Marian and her colleagues recorded the eye movements of Russian-English bilinguals while giving them instructions in one language (e.g., “*Podnimi marku*” /Pick up the stamp/). The recording showed that while participants’ eyes focused on the stamp they also looked briefly at the objects with a phonologically similar name in another language (e.g., a marker, /*flomaster*/ in Russian). Similar results were obtained in research on cross-linguistic orthographic priming with French-English bilinguals (Bijeljac-Babic et al. 1997). In the lexical decision task, orthographically related words in French and English tended to inhibit each other, indicating that printed strings of letters can simultaneously activate lexical representations in each of the bilingual’s languages.

Thus, semantically unrelated words in bilingual lexicons can activate each other if they share similar lexical features. This assumption accords with the distributed lexical/conceptual feature model that presumes a set of distributed lexical features shared by both lexicons. Common lexical features can send the activation to the lemmas in different languages thereby initiating the lemma-mediated cross-language transfer. For example, the oral presentation of the English word “marker” to English-Russian bilinguals may activate a set of phonological features that are present in both “marker” and “*marka*.” These features therefore activate the lemma {marker} in the English lexicon and the lemma {stamp} in the Russian lexicon. These lemmas in turn activate the conceptual representations of the marker and the stamp, which appear to be unrelated in a monolingual lexicon. As a result, concepts from distant unrelated categories are activated, which may promote divergent thinking in bilinguals to a greater extent than in their monolingual counterparts.

7. THE EFFECTS OF CROSS-LINGUISTIC
EXPERIENCE ON DIVERGENT THINKING IN THE
FRAMEWORK OF THE BILINGUAL MEMORY MODEL

In the framework of bilingual memory proposed in this study, cross-linguistic experience is theorized to have an influence on the lexical-conceptual routes by establishing stronger and more efficient connections between conceptual and lexical representations. The following subsections discuss the possible influence of the age of L2 acquisition and language proficiency on the communication routes between these representations. More efficient communication in bilingual memory may promote a greater activation flow that simultaneously activates concepts from distant categories and therefore may result in superior divergent thinking performance. Note, however, that these assumptions are speculative and require extensive empirical investigation.

7.1. Age of L2 Acquisition

Individuals who acquired both of their languages early in life may develop a greater sensitivity to underlying concepts and more refined connections between lexical and conceptual representations. If bilinguals acquired both of their languages early and underwent an equal development in both languages, they might be able to establish equally strong direct links from both lexicons to the conceptual system. These links can be reinforced by a constant exposure to both languages in combination with frequent language switching. Thus, bilinguals who acquired their languages early in life would have two equally developed lexical systems connected to a shared conceptual one. This presumably fosters cross-language transfer by providing fast routing of informational exchange between both lexicons and the concepts.

On the other hand, individuals who acquired their L2 later in life first establish the links between their L1 lexicon and their conceptual system. During L2 learning they initially access the meanings for L2 words through L1 and only later become able to conceptually mediate L2 directly. The shift from reliance on L1 to direct conceptual processing of L2 may result in creating an asymmetry in lexical access (see Kroll & de Groot 1997). Late bilinguals would have more lexical-conceptual

connections from L1 than from L2, and the strength of these links would be different for first and second languages. Due to lexical access asymmetry, more conceptual features can be accessed through L1 than through L2. Since the vast majority of the conceptual system in late bilinguals was established during L1 acquisition, and since L2 lexical features were mapped to the conceptual features through the L1 lexical-conceptual route, there might be fewer shared conceptual features that have direct links from both lexicons in the memory of individuals who acquired L2 later in life. This may result in a less efficient cross-language transfer, and consequently in poorer divergent thinking performance. Indeed, this study shows that bilinguals who acquired L2 earlier in life outperformed those who acquired L2 later on the fluency and flexibility ATTA measures.

7.2. Language Proficiency

The influence of the age of L2 acquisition on modifications in bilingual memory can theoretically be complimented by the effect of language proficiency. If the age of L2 acquisition may determine the directions of lexical-conceptual routes, the proficiency in L1 and L2 may determine the strength of connections between the lexical and conceptual systems. The degree of linguistic skills may influence the intensity of lexical access: greater language proficiency may result in establishing stronger and more elaborate links to the conceptual system. As a result, more concepts become readily available for cross-language transfer. Following this assumption, bilinguals who attained high expertise in both languages would have stronger and more efficient links between lexical and conceptual levels than those who were not able to develop any of their languages to a high degree. Thus, bilinguals highly proficient in both languages would employ the cross-language transfer mechanism more effectively and therefore may show greater divergent thinking performance compared to their less proficient counterparts. The present study supports this theory by showing that bilinguals with higher composite PNT score scored higher on the elaboration ATTA measure.

Altogether, both factors in cross-linguistic experience are theorized to influence connections between lexical and conceptual representations

in bilingual memory. Early bilinguals may develop equally elaborated direct links between the L1 and L2 lexicons and the conceptual system, whereas late bilinguals are likely to develop an asymmetrical system, in which L1 mediated route is more elaborated than L2 mediated one. In the same fashion, bilinguals with greater expertise in both languages would establish stronger links between the L1 and L2 lexicons and the conceptual system compared to their less linguistically proficient counterparts. The highly developed lexical-conceptual routes may facilitate the cross-language transfer, which in turn, as proposed above, may promote divergent thinking.

8. CONCLUSION

In this chapter several research questions pertinent to the influence of bilingual development on individuals' divergent thinking abilities were explored. First, bilingual participants were found to outperform their monolingual counterparts in fluency, flexibility, and elaboration, but not in originality in divergent thinking. These findings provide an explanation for the apparent contradiction between bilinguals' superiority over monolinguals on creativity tests in the lab setting and no performance differences between the representatives of these two groups in real life creativity. This study claims that being bilingual does not necessary imply being creative. Bilinguals' advantage was found for the divergent thinking traits that refer to simultaneous activation and elaboration of multiple unrelated concepts from distinct categories, but not for the trait that deals with the ability to extract unique and original solutions. Thus, the positive effect of bilingualism on creative abilities is likely to be limited to basic cognitive processing, which lays the foundation of more sophisticated processing during which truly creative ideas may be extracted. The effectiveness of the latter cognitive processes, however, might be influenced by various developmental factors different from bilingualism (e.g., intelligence, education, motivation, personal experience).

Second, the cross-language transfer is proposed as a cognitive mechanism underlying divergent thinking. A specific architecture of bilingual memory in which two lexicons are mutually linked to the

conceptual system is argued to facilitate this process. Due to elaborative cross-language transfer, different concepts from unrelated categories can be activated simultaneously, which may account for bilinguals' greater performance on fluency, flexibility, and elaboration in divergent thinking. Two factors in bilingual development are proposed to facilitate cross-language transfer. The age of L2 acquisition might determine the way bilinguals' two lexicons are connected to their conceptual system. Language proficiency might enrich the links between bilinguals' lexicons and their conceptual system. Together, these factors of cross-linguistic experience are assumed to play an important role in establishing an elaborated lexical-conceptual system in bilingual memory that is theorized to facilitate the cross-language transfer assisting divergent thinking. However, this claim warrants further empirical investigation.

Third, although no significant correlation was found between bilinguals' cross-cultural experience and their divergent thinking performance, several particularly important directions for future research into bilingualism could be advanced. Bilingualism should be studied not only in the context of individuals' linguistic abilities, but also in a sociocultural context. The psychological ramifications of living in two cultures on an individual's behavior and reflections on the impact of cross-cultural experience on the conceptual system open a new line of research on biculturalism that should bring together the efforts of cognitive and social psychologists. Moreover, disregarding the joint operation of these factors puts research outside the mainstream of psychological investigation. Furthermore, in studying the psychological effects of cross-cultural experience, one should carefully examine the time and circumstances of this experience. In addition, the peculiarities of the cultures to which an individual is exposed should be taken into account. In this regard, a question that needs to be answered is what cultural cues might have an effect on the conceptual changes that presumably influence the individual's cognitive development.

Finally, the findings of this study also lend indirect support to the creative cognition approach (Ward et al. 1999). On one side, bilinguals seem to utilize the same cognitive mechanisms of concept formation and lexical access that are used by all people. On the other, they tend

to show greater divergent thinking abilities. Thus, the various uses of mundane cognitive functioning may result in superior divergent thinking performance.

Altogether, this study emphasizes the importance of bilingual education. Most of the policy debates over bilingual education have turned on issues relating to implementation, assessment and whether existing programs provide appropriate job training. Lost in much of the often-angry disputes (e.g., the “Unz Initiative” – Prop. 227 in California) is a central question: Does bilingual education have a particular and measurable impact on cognitive functioning? This study provides a hint of the contribution of bilingualism to cognitive development in children. In particular, cross-linguistic and cross-cultural factors in bilingual education might be beneficial for individuals' cognitive growth and creative abilities. With the latter, the idea that a high level of creative performance can be stimulated by reinforcing the same cognitive functions that are used in everyday activities suggests the importance of encouraging creative factors in education (Schank & Clearly 1995). In this direction, the methodologies of bilingual education should be studied with the potential to look into educational programs that are oriented towards creativity.

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NOTES

1. One of the widely used definitions of creativity indicates that this is an ability to produce work that is novel (i.e., original or unexpected), appropriate (i.e., useful or meets task constraints; e.g., Sternberg & Lubart 1995), and can be “put to some use” (Martindale 1989, p. 211).

2. The term “culture” has numerous overlapping meanings that sometimes are misleading and provide unclear definitions. Traditional associations with the word “culture” refer to the art, knowledge, and sophistication gained through exposure to the art exemplars as well as to the artistic and literary heritage of a particular nation. In this work, culture reflects social and anthropological aspects of human behavior. It is defined as a set of beliefs, moral norms, customs, practice, and social behavior of a particular nation or group of people whose shared beliefs and practices identify the particular place, class, or time to which they belong.
3. The present study defines bilingualism in the broadest possible terms including individuals who are fluent in at least two languages, individuals who actively use, or attempt to use, more than one language, even if they have not achieved fluency in the second language (Kroll & de Groot 1997).
4. The CEC was introduced to account for a strong argument in acculturation literature that the age of arrival and the length of residence in a new country are conceptually different and have different implications for immigrants of different ages (e.g., Birman & Trickett 2001). Individuals who were exposed to different cultures early or late in life may develop perceptual differences of L1 and L2 cultural values, which might be rooted in variations in their cognitive functioning. The present study assumes that it is prudent to measure the length and the age of individuals’ exposure to both cultures since the frequency and recency of exposure to different cultural settings may have impact on the cognitive system.
5. Note that they were overwhelmingly immigrants from the former Soviet Union residing in Brooklyn, and therefore might have been influenced by the pervasive Russian immigrant community of Brooklyn.
6. The distributed nature of the lexical features presumes that the same word forms can be shared by words in each language. For example, a word “marker” in English shares phonological features with a Russian word “marka” /stamp/. This is a particularly important notion for understanding a phenomenon of a cross-language transfer as discussed below in a section on the word form mediated association routes in bilingual memory.

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