ON THE POSSIBLE RELATIONSHIPS BETWEEN BILINGUALISM, BICULTURALISM AND CREATIVITY: A COGNITIVE PERSPECTIVE

by

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ABSTRACT

On the possible relationships between bilingualism, biculturalism and creativity: A cognitive perspective

by

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This study explores the hypothesis that bilingualism and/or biculturalism encourage divergent thinking and cognitive flexibility, which together facilitate creative thought. In the cross-regional study, 98 Russian-English bilingual college student immigrants living in the United States and 130 Russian-English bilingual university students living in Russia were compared with 47 monolingual English native speakers. Bilinguals were classified by their exposure to American and Russian cultures and their proficiency in English and Russian. Self-report questionnaires were used to assess participants' cultural and linguistic background. Language proficiency was assessed using a modified version of the Picture Naming task, and divergent thinking abilities were assessed with the Abbreviated Torrance Test for Adults (ATTA). It was shown that when the effect of biculturalism was partialed out, bilinguals who were highly proficient in at least one language outperformed monolinguals on the parts of the ATTA that tested ability to simultaneously activate multiple unrelated concepts (fluency) and keep them active during the thought process (elaboration). This finding suggests that although bilingualism may lay the foundation for creative thinking, it does not necessary imply

being creative. When the effect of bilingualism was controlled for, cross-cultural (or, possibly, subcultural) experience had a negative effect on divergent thinking. These findings suggest that bilingualism should be studied not only in the context of individuals' linguistic abilities, but also in the sociocultural context. Finally, a spreading activation process is proposed as a cognitive mechanism underlying basic processing in divergent thinking. A specific architecture of bilingual memory in which two lexicons are mutually linked to the conceptual system is speculated to facilitate the functioning of spreading activation mechanism.

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As I finish this work and seek new commitments, it is appropriate to comment on my feelings as I conclude this important phase of my creative development in graduate school. This document is a product, both of my intellectual achievements and of a complex amalgam of enviable asceticism and social confrontation, which, together, have facilitated and marked my spiritual growth. This was a path of self-comprehension and self-realization, a way of great love and contemplation, one for which I am personally and professionally grateful.

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INTRODUCTION

There is a long-standing debate in the creativity literature whether the capacity for creative thought is limited to a certain class of gifted or specially talented people or this creative capacity is an essential property of normative human cognition. The former view considers creative people as a minority who is 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, Smith, & Finke, 1999).

Beyond the obvious examples of artistic, scientific, and technological advancement that are usually listed as instances of creativity, there is the subtler, but equally compelling generativity associated with everyday thought. One of the most striking examples of this generativity is the productivity of language: we are able to construct an infinite number of grammatical sentences using a limited number of words and a small set of rules (Chomsky, 1972; Pinker, 1984). In the creative cognition view, the generativity goes beyond everyday human cognition 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., Eysenck, 1995; Simonton, 1994). Although the creative cognition approach admits these differences, they can be understood in terms of variations in the use of specifiable processes or combinations of processes, the intensity of application of such processes, the

richness and flexibility of stored cognitive structures to which the processes are applied, the capacity of memory systems (such as working memory) and other known and observable fundamental cognitive principles (such as memory retrieval, mapping of old knowledge onto novel situations, conceptual structures, knowledge combination and manipulation) (Ward, Smith, & Vaid, 1997).

This study argues against the notion that extraordinary forms of creativity are the products of mysterious and unobservable processing, and advocates belief in the continuity of cognitive functioning between mundane and creative performance. The purpose of this project was to evaluate the creative cognition approach that states that creativity may result from normative human cognition. In this framework, bilingualism is hypothesized to encourage divergent thinking and cognitive flexibility, which together facilitate creative thought. The study is part of a larger research program designed to examine the factors in bilinguals' development that may contribute to their cognitive and creative abilities.

Creativity and Divergent Thinking

Throughout the history of human civilization, numerous attempts to understand human creativity have been made. The interest in human creative capacity never ceased and contemporary creativity researchers are still arguing about the definition of creativity. 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). There is agreement in the literature that creative thinking is a complex process that may include problem definition and redefinition, divergent thinking,

synthesis, reorganization, analysis, and evaluation (Getzels & Csikszentmihalyi, 1976; Lubart, 1994, 2000; Ochse, 1990; Sternberg, 1999; Sternberg & Lubart, 1995). Therefore, as Guilford (1950) suggests, the creative process may be effectively studied by examining the subprocesses that play a role in creative work.

During the past 50 years, a large number of studies have explored the nature of the subprocesses involved in creativity, and a large class of models was proposed to describe these subprocesses. However, most of these models seem to focus on similar kinds of processing. 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 Rothenberg's (1979) idea of homospatial thinking that "consists of actively conceiving two or more discrete entities occupying the same space, a conception leading to the articulation of new identities" (p. 7). On the other hand, Koestler (1968) introduces the concept of bisociation, which he defines as 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 – an ability of creative individuals to build connections between unrelated ideas or objects (Mednick, 1962).

Despite a large number of proposed models, most of them seem to converge on the idea 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. Other models focus on the mechanism underlying the ability to activate several unrelated concepts at the same time (e.g., Lubart & Getz, 1997; Ward et al., 1997; Weisberg, 1993). For example, Lubart and Getz proposed an emotional resonance

mechanism by which emotion-based endocepts that are attached to the specific concepts or images in memory communicate with each other by means of an automatic resonance mechanism that propagates an active emotional pattern throughout memory.

Although these models are fuzzy and provide no clear description of subprocesses underlying creative thinking they all seem to emphasize the important property of creative thought – ability to establish distant associations that link concepts from distant categories. The communication between concepts is assumed to be an unconscious process during which the activation is propagated throughout the conceptual network. These subprocesses are likely to resemble divergent thinking that involves a broad search for information 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); originality (the tendency to produce ideas different from those of most other people); and elaboration (the ability to think through the details of an idea and carry it out). He contrasted divergent thinking with convergent thinking – the ability to narrow all possible alternatives down to a single solution. Divergent thinking remains a key topic in the creativity literature (e.g., Finke, Ward, & Smith, 1992; Khandwalla, 1993; Runco, 1991). For example, Mumford, Mobley, Uhlman, Reiter-Palmon, and Doares (1991) indicated several ways in which the creative problem solving process differs from the standard, noncreative process. The major difference is rooted in the ability to initiate multiple cycles of divergent and convergent thinking, which creates an active, attention-demanding process that allows

generation of new, alternative solutions. In contrast, in routine problem solving, people apply previously acquired procedures and search for ready-made solutions, all of which involve mainly convergent thinking (see also Mayer, 1999).

In sum, although previous research has not provided sufficient empirical data, it has introduced models of creative processing that identify a number of subprocesses that may lead to the creative product. Most of these subprocesses involve cycles of divergent and convergent thinking, which generate and explore a large set of diverse ideas underling creative thought. Moreover, some studies perceive divergent thinking as one of the major components of creativity (e.g., Guilford, 1967). The next section presents a discussion in the literature concerning whether divergent thinking can be considered as an important part of creative process.

The relationship between divergent thinking and creativity

In studying various aspects of giftedness and creativity, a number of theorists and investigators have emphasized divergent thinking abilities in the creative process. There is a growing body of research investigating the relationship between creative and divergent thinking abilities (e.g., Barron & Harrington, 1981; Sternberg & Grigorenko, 2000; Stokes, 2000). Over the last half century, numerous studies have provided evidence for the ability of divergent thinking tests to predict certain aspects of performance on creative problem-solving tasks (e.g., Basadur & Hausdorf, 1996; Plucker & Renzulli, 1999; Runco, 1991) and real world creative achievement (e.g., Hocevar, 1980; Mumford, Marks, Connelly, Zaccaro, & Johnson, 1998).

However, there is a meaningful argument that questions this relationship. For example, some researchers argue that the validity of divergent thinking tests may depend,

in part, on the scoring procedures being applied (e.g., Mumford et al., 1998; Runco & Mraz, 1992). Other researchers argue that divergent thinking tests are weakly related to other kinds of creativity ratings and therefore measure only a small portion of creativity (e.g., Amabile, 1996; Hocevar, 1981; Wallach & Kogan, 1965). Still others question the nature of divergent thinking tests as the measures of creativity at all. They argue that this relationship is rather between divergent thinking and other types of cognitive capacities such as intelligence (e.g., Carrol & Maxwell, 1979; Merrifield, Guilford, Christensen, & Frick, 1962; Sternberg & O'Hara, 1999). In a broader sense, Barron and Harrington (1981) criticized the idea that eminent creative performance can be explained by mundane cognitive processing such as divergent thinking. They noted that there was remarkably little evidence revealing divergent thinking abilities in highly creative people.

On the other side, some researchers see the traces of divergent thinking in eminent individuals. For example, Stokes (2000) noted, "Matisse, Picasso, and Calder displayed divergent thinking in using a multiplicity of styles and media. Think of the innovative paper sculptures made by Picasso during his Cubist period; of Matisse's late, great cut-outs, the culmination of his pursuit of an art of pure line and pure color; of Calder's whimsical, wire-constructed contour 'drawings' in three dimensions" (p. 279).

Although, as Runco (1991) noted, "Divergent thinking is not synonymous with creative thinking", many researchers believe that divergent thinking is an important component of the creative process. For example, Runco (1986) explored the relationship between divergent thinking test scores and creative performance in 96 gifted and 116 nongifted children. The criterion of creative performance was a self-report that estimated the quantity and quality of extracurricular activity in different domains (e.g., writing, art,

music, science). He found that divergent thinking and creative performance scores were moderately related in the gifted sample but unrelated in the nongifted sample. In a more recent study, Vincent, Decker, and Mumford (2002) examined the relationship among intelligence, expertise, and divergent thinking as they influence creative problem-solving and performance in a sample of 110 military leaders. Divergent thinking was measured using Christensen, Merrifield, and Guilford's (1953) consequences test known to capture aspects of divergent thinking relevant to leaders' problem-solving efforts (Mumford et al., 1998). In this study, divergent thinking correlated with idea generation and idea implementation more strongly than intelligence and expertise. The study suggested that divergent thinking has unique effects on creative problem solving that could not be attributed to the other cognitive capacities.

To conclude, although divergent thinking is not identical to creativity, it appears to play an important role in the creative process. Therefore, exploration of factors in individuals' development facilitating divergent thinking may shed some light on their creative functioning.

Divergent thinking tests as a creativity measure

In the view outlined above, creative abilities can be measured using a strategy of divergent thinking tasks developed by Guilford and his colleagues (e.g., Alternative Uses, Christensen, Guilford, Merrifield, & Wilson, 1960; Plot Titles, Berger & Guilford, 1969; and Consequences, Christensen et al., 1953) that have been adopted by many creative cognition researchers (e.g., Mednick & Mednick, 1967; Torrance, 1966; Wallach & Kogan, 1965).

Torrance Tests of Creative Thinking

The most widely used tool in creativity research is the Torrance Tests of Creative Thinking (TTCT, Torrance, 1966) developed to measure divergent thinking abilities in children. Hakuta (1984) expressed the rationale behind the TTCT in following: "For Torrance, creativity is closely identified with divergent productions and transformations with the ability to take different perspectives and different approaches to a given problem". This test consists of relatively simple verbal and figural tasks that tap into divergent thinking abilities as well as in other problem-solving skills. The TTCT have been used in about three-quarters of all recently published studies of creativity involving elementary and secondary school children (Baer, 1993) in the US (e.g., Davis, 1989; Runco, 1993) and across the globe (e.g., Kim & Michael, 1995; Niaz & Saud de Nunez, 1991). Moreover, a number of the studies using the TTCT have been conducted with bilinguals speaking different languages (e.g., Chinese-English and Malayan-English in Torrance, Gowan, Wu, & Aliotti, 1970; French-English in St. Lambert Project, see Lambert, 1975, for a review; Japanese-English in Konaka, 1997).

The most extensive evidence of the validity of the tests comes from Torrance's longitudinal studies with elementary and high school students initiated in 1958 and 1959. These studies have produced strong evidence of relationships between test performance and real-life creative achievement (see Torrance, 2000, for a review). Using the TTCT, Torrance identified a variety of abilities that seem to be important in producing creative responses: fluency (total number of relevant responses), originality (the statistical rarity of responses), elaboration (amount of detail in the responses), and flexibility (number of different categories of relevant responses).

However, there certainly have been questions about the predictive validity of the tests with respect to adult creative achievement (e.g., Baer, 1994; Gardner, 1993; Wallach, 1976). A recent study by Plucker (1999) provided additional support in favor of the TTCT. Plucker used structural equation modeling to reanalyze Torrance's longitudinal data on predictive validity and found that creativity scores on the TTCT accounted for about half of the variance in adults' publicly recognized creative achievements and participation in creative activities obtained several years later. This corresponds to a predictive validity coefficient of about .70, which suggests that the TTCT's scores differentiate well between individuals who subsequently go on to achieve public acclaim as creative and those who do not. Interestingly, the TTCT predicted about three times as much of the criterion variance as IQs.

Since giving both the Verbal and Figural forms of the TTCT often requires considerable testing time (45 minutes for the Verbal and 30 minutes for the Figural), Torrance and his colleagues developed a shortened version. The new test, the Demonstration Form of the Torrance Tests (D-TTCT, Torrance, Wu, & Ando, 1980) consists of activities utilizing the same rationale as activities in the original TTCT, but in abbreviated form and requiring considerably less testing time. The D-TTCT was found suitable for adult populations, including older adults (Horng, 1981; Torrance & Safter, 1999; Townsend, Torrance, & Wu, 1981). This test was then converted to the current Abbreviated Torrance Test for Adults (Goff & Torrance, 2002) that was employed in this study. The adult version contains three 3-minute tasks that can be scored for fluency, originality, elaboration, and flexibility.

Problems with divergent thinking tests as creativity measure

Do divergent thinking tests measure creativity? The major critique that the divergent thinking tests receive in the literature is whether these tests indeed measure creative abilities. For example, Guilford and his colleagues have assumed that divergent thinking is somehow linked to creative behavior. The personality psychologists have suggested that some personality traits are linked to creative behavior. Others have claimed that individuals' attitudes and intentions or their past experiences are related to creative behavior. Each of these approaches has its own strategy of creativity assessment. For example, Hocevar (1981) listed ten different types of creativity measurement: "tests of divergent thinking, attitude and interest inventories, personality inventories, biographical inventories, teacher nominations, peer nominations, supervisor ratings, judgments of products, eminence and self-reported creative activities and achievements" (p. 450). Each of these approaches is widely used and accepted for identifying creative talent. However, the problem with all these methods is that although they all claim to measure creativity, they lack validity among themselves. As Hocevar noted, "Since each method is purported to be measuring creativity, it is reasonable to predict that they be correlated, thus satisfying a minimum condition of convergent validity" (p. 457). It turns out, however, that divergent thinking tests do not correlate with other tests of creative abilities.

In another example, Davis and Belcher (1971) found no significant correlation between two tests of divergent thinking, a biographical inventory, and self-rating scores on several creative activity questions. A similar finding was reported in a study of art students whose creative abilities were obtained using two teacher ratings, eight tests of

divergent thinking, two personality inventories, grades, and IQ scores (Getzels & Csikszentmihalyi, 1964). In another study of art students, Ellison (1973) found low and negative relationships between judged creativity on a pastel drawing, the Remote Associations Test (Mednick & Mednick, 1967) and the Barron-Welsh Art Scale (Barron & Welsh, 1952). Moreover, even in the studies that reported a significant positive correlation between divergent thinking and other creativity measurements (e.g., Bartlett & Davis, 1974; Wallbrown & Huelsman, 1975), the correlation is seldom higher than .30, suggesting that the two measures share only up to 10 percent of the variance in common.

Are divergent thinking tests domain specific? A number of studies made the case against divergent thinking tests as an all purpose creative thinking assessment (e.g., Baer, 1993; Brown, 1989; Hocevar, 1981). For example, Brown believes that failure of divergent thinking tests to provide a sufficient measure of creativity can be explained by the inability of this test to assess different creative activities. He says: "We can see why the initial promise of divergent thought has not been fulfilled. Implicitly or explicitly, creativity theorists viewed divergent thought as a fairly general process that would account for a variety of creative activities. But several lines of research and theory (e.g. Amabile, 1983; Hocevar, 1981; Wallach, 1986) are converging on the conclusion that talent and creativity are domain specific whether by dint of "natural" proclivity, extensive training, and/or education" (p. 22).

Are divergent thinking tests not just a measure of intelligence? In addition, some researchers question whether divergent thinking is actually just a measure of intelligence. To answer this question, attempts have been made to establish the correlation between measures of intelligence and divergent thinking skills (e.g., Guilford,

1967; Magnusson & Backteman, 1978; Torrance, 1966). The results obtained in these studies indicated moderate positive correlations (in the .20 to .40 range) of divergent thinking tests, typically scored for fluency, with measures of intelligence (Barron & Harrington, 1981). The positive correlation suggests that there is some relationship between these two.

However, a low correlation value indicates that measures of divergent thinking skills might capture a capacity distinct from intelligence. The latter was supported by Guilford and Christensen (1973) who proposed that the relationship between divergent thinking abilities and intelligence becomes weaker after one passed some threshold level in basic cognitive capacity. This finding was replicated in a number of studies, in which the independence of divergent thinking and intelligence at above-average IQ levels was reported (e.g., Getzels & Jackson, 1962; Torrance, 1962; Wallach & Kogan, 1965). However, the value of the minimal IQ threshold varies from 90 in Lehman, Kahle, and Nordland's (1981) study to 132 in Torrance's (1962) study suggesting that there is no clear IQ level at which divergent thinking separates from intelligence.

Further, some researchers argue that the magnitude of this relationship depends on the heterogeneity of the sample being used, with larger correlations being obtained in more heterogeneous samples (Hattie, 1980; Metcalfe, 1978; Vernon, 1964). Others see the magnitude of this relationship as a function of the domain being examined, with stronger relationships between divergent thinking and intelligence in intellectually demanding domains (Barron & Harrington, 1981) such as management and engineering (Mumford, Peterson, & Childs, 1999).

Conclusion

A number of studies showed that divergent thinking is related to creativity. In the framework of creative cognition approach, divergent thinking seems to be that normative cognitive mechanism, which intensified exploitation may result in increase in creative abilities. This study hypothesized that certain factors in bilingual development may promote creativity, because of their positive influence on bilinguals' cognitive system. In particular, they were hypothesized to facilitate some cognitive functioning (Bialystok, 1988; Cummins, 1978), which in turn may increase divergent thinking and creative abilities.

The following section presents a discussion on the relationship between bilingualism and cognition. There is a strong argument in the literature that bilingual development may result in establishing specific architectures of bilingual mind that are likely to promote later cognitive advantages (Kroll & de Groot, 1997). Therefore, first the discussion of the relationship between bilingualism and cognitive functioning in children is presented.

Bilingualism and Cognition

Bilingualism and cognitive development in children

The majority of the studies on bilingualism and cognition have been conducted with children. The low interest in the cognitive advantages of bilingualism in adults can be explained by the focus of most researchers on the educational issues, how to raise bilingual children, and possible consequences of bilingual development (see de Groot & Kroll, 1997; and Runco, 1991, for a review). In this regard, several questions concerning

the relationship between bilingualism and cognition have been raised. Does the possession of two languages hinder or facilitate effective thinking process? Do bilinguals, operating on two linguistic systems, have more or fewer cognitive advantages? Do bilinguals receive, transfer, store, and reproduce thoughts differently than monolinguals? In answering these questions, two major views on bilingualism and cognition have been proposed (see Cook, 1997, for a review). Researchers advocating a "subtractive" view believe that bilingualism has a negative effect on cognitive development, because learning a second language means subtracting something from the monolingual state. There is a large body of empirical data that shows that bilingual development causes deficiency in the processing of first (L1) and second (L2) languages (e.g., Cook, 1990; Lehtonen & Sajavaara, 1988; Maegiste, 1992).

In contrast, in the "additive" view on bilingualism, speaking two languages extends rather than diminishes the individual's capabilities, which is also supported in a large number of empirical studies (e.g., Hakuta & Diaz, 1985; Peal & Lambert, 1962; Ricciardelli, 1992a). These researchers believe that having two labels will force an early separation of a word from its referent, leading to a more analytic orientation, flexibility, and superiority in concept formation, which in turn makes bilingual children show greater performance on a variety of measures of cognitive skill.

One might suppose that, given two clearly opposing view points, resolution would be easy. Unfortunately this has not proven to be the case, although, as will become clear, the evidence is beginning to favor the latter, "additive" perspective.

Metalinguistic awareness and cognitive flexibility

There is an opinion in the literature that one of the reasons for a positive effect of bilingualism on individuals' cognitive abilities can be attributed to metalinguistic awareness – the awareness of language itself, independent of the message it is conveying (see Reynolds, 1991). There has been a long debate on the relationship between bilingualism and metalinguistic awareness. Evidence for a facilitating effect (e.g., Bialystok, 1988; Cummins, 1978; Ianco-Worrall, 1972), an inhibiting effect (Palmer, 1972), and no effect (Rosenblum & Pinker, 1983) of bilingualism have been reported. Some investigators found effects in both directions when studying different samples of bilingual children (e.g., Ben-Zeev, 1977; Cummins, 1978).

A positive effect of bilingualism on metalinguistic abilities appears in understanding the word-referent distinction and the arbitrariness of language. Bilinguals know that the same object can have different names; therefore they can detach the name from the object much easier. In a classic experiment with four to nine years old bilingual children, Ianco-Worrall (1972) reported that more than twice as many bilingual children as monolingual children agreed that a dog could be called *cow* and a cow called *dog*. The awareness of the arbitrariness of language might provide bilinguals with a more analytic approach to concept formation. They have to conceptualize things in their general properties rather than relying on their linguistic symbols, which might facilitate their flexibility in thinking. Other studies with bilingual children revealed a positive effect of knowing another language on metalinguistic abilities, such as sensitivity to language structure and details (Ben-Zeev, 1977), and correction of ungrammatical sentences and detection of language mixing (Diaz, 1985).

Bilingualism and cognitive flexibility in adults

The reviewed studies show that bilingual children benefit from metalinguistic awareness that influences their cognitive development. The present study focuses on the factors in bilinguals' development that may facilitate the cognitive skills beyond their linguistic abilities and lead to increase in general cognition. In the creative cognition approach, increases in general cognitive functions might facilitate individuals' creative abilities. Indeed, a review of previous research with children (Ricciardelli, 1992b) showed that bilinguals have an advantage over monolinguals on tests of cognitive and creative skills. Although very few studies report on the relationship between bilingualism and cognition in adults, it is reasonable to think that certain factors in bilingual development may leave a trace in individuals' cognitive system. The modified cognitive system may facilitate bilinguals' cognitive flexibility, which consequently influences their cognitive and creative functioning.

It is not altogether clear what might underlie this possible greater cognitive flexibility, but one possibility is that bilinguals' metalinguistic awareness occurs as a result of changes in the links between lexical and conceptual representations. Bilinguals' constant exposure to different linguistic and/or cultural cues increases their ability for repeated switching between linguistic and/or conceptual systems, which is assumed to facilitate the flexibility in thinking (Peal & Lambert, 1962).

This study hypothesizes that two factors in bilinguals' development (linguistic skills and cross-cultural experience) may modify the structure of their memory, which may manifest itself in greater cognitive flexibility and consequently in remarkable divergent and, by extension, creative abilities.

The role of linguistic skills in bilinguals' cognition

There is agreement in the literature that the degree of proficiency in both languages serves as a critical factor in the relationship between bilingualism and cognitive abilities. Brain studies support this notion by showing that bilinguals' hemispheric involvement differs as a function of the degree of proficiency in each of their languages (e.g., Maegiste, 1992; Perani et al., 1998; Vaid & Genesee, 1980). The different patters of cortical activation in bilinguals' brain may suggest that they employ certain cognitive mechanisms differently. In the framework of this study, different utilization of these mechanisms may lead to increase in cognitive functioning.

Indeed, in verbal learning and memory tests Harris, Cullum, and Puente (1995) reported that dominant[1] Spanish-English adult bilinguals retain fewer words in their L2 (English) than do balanced bilinguals in their L2 and English-speaking monolinguals in English. These differences disappeared however when the bilinguals were tested in their dominant L1 (Spanish). This finding was interpreted in favor of a Threshold Hypothesis (Cummins, 1976) that states that bilinguals need to achieve high proficiency in both of their languages before bilingualism can promote cognitive advantages. This theory was supported by studies of children (e.g., Cummins, 1976; Diaz, 1985; Ricciardelli, 1992a) in which participants who did not reach a certain proficiency level in each of their languages showed poorer performance in a variety of cognitive tasks compared with monolinguals. Therefore, Cummins argued that bilingualism might have a negative

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[1] In bilingualism literature, balanced bilinguals are assumed to have equivalent competence in both languages whereas dominant bilinguals are assumed to speak one of their languages better than the other (Lambert, 1955).

impact when the child cannot fully benefit from educational experiences because of inadequate language competence.

The role of cross-cultural experience in bilinguals' cognition

In studying the effect of bilingualism on cognitive abilities the fact that most bilinguals experience and participate in two cultures[2] is generally disregarded. As a number of acculturation studies (e.g., Birman, Trickett, & Vinokurov, 2002; Gordon, 1964) show, successful language acquisition goes hand in hand with cultural adaptation. For example, Schumann's (1978) acculturation theory was based on the notion that language is one aspect of culture. His model proposed that the degree to which an individual acculturates within a new linguistic community predicts his or her abilities to acquire L2.

As discussed above, bilinguals' cognitive advantages are usually associated with the virtue of developing two linguistic systems, which was assumed to result in metalinguistic awareness and cognitive flexibility. However, there is an alternative view that states that this effect can be attributed not to the cross-linguistic variations, but to the

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[2] The term culture has numerous overlapping meanings that sometimes are misleading and provide "fuzzy" definitions (Appel, 2000; Francis, 2000). Traditional associations with the word "culture" refer to the art and 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, however, culture reflects rather 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 a group of people whose shared beliefs and practices identify the particular place, class, or time to which they belong. A set of common mental models, cultural scripts, and "interpretive frames" (see Pavlenko, 2000) characterizes these people and suggests strategies in solving problems and dealing with a variety of situations in a culture-specific way.

cross-cultural values adopted during L1 and L2 learning (e.g., Kessler & Quinn, 1987). As Peal and Lambert (1962) put this over forty 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). In this framework, it is not the "experience with two language systems", but the experience with two systems of cultural values and norms that may be having an impact on bilinguals' cognitive functioning and result in cognitive flexibility.

This study suggests that bilinguals' cross-cultural experience may result in qualitative modifications in the conceptual system, which might have an impact on their cognitive flexibility. In recent years this theme has been taken up by a number of researchers (e.g., de Groot, 2000; Paradis, 2000; Pavlenko, 2000) arguing that conceptual systems of individuals who acquired more than one language inevitably undergo adaptations influenced by the cultural and social contexts in which these languages were learned. Since cultural experience is deeply rooted in higher-order linguistic structures such as polysemy, metaphor, irony, and other non-literal aspects of language, successful language acquisition is likely to be accompanied by the acquisition of cultural knowledge (in the form of schemas and frames), which modifies conceptual representation and organization in bilingual memory (Vaid, 2000). In this respect, two individuals who speak different languages and participate in different cultures would have different conceptual systems developed as a result of cultural experience. Russians in Russia, for example, will interpret an event in the light of conceptual representations developed in Russian ways of thinking; North Americans will have another interpretation of the same

event in accordance with American ways of thinking; whereas Russian immigrants in America will have their interpretation depending on the degree of acculturation into a new culture, i.e. the extent to which they have been exposed to the new culture and adopted the new values relative to the old ones (Pavlenko, 1999).

It is important to note, however, that the structure of bilinguals' cognitive system is not just a combination of two monolingual cognitive systems with separate concepts and lexicons. The experience of bilinguals varies depending on their isolation or participation in the new culture as well as in a bilingual community. For example, Ervin-Tripp (2000) notes that "American Nisei have not learned Japanese speech etiquette and are seen as rude in Japan, and American Lebanese may lack classical Arabic allusions for formal situations" (p. 11). For this reason, she continues, "We cannot expect to find a simple match between bilingual and monolingual cognitive or semantic features.... Bilinguals have a different access to experience; they can observe in more than one community, so we cannot expect their concepts to be matched to monolinguals at all times". New connotations, even entirely new meanings, may develop through acculturation.

Summarizing, the process of learning two languages may be accompanied by the acquisition of different categories of concrete objects and abstract notions that reflect cross-linguistic and cross-cultural differences. These conceptual representations allow bilinguals to see the same phenomenon from different perspectives. Thus, 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 (Carringer, 1974; Cummins & Gulutsan, 1974; Lopez,

2003; Okoh, 1980). The specific organization of a bilingual conceptual system may promote the integration of different, often contradicting, concepts which may result in a dual perspective and consequently in increased cognitive flexibility and creative abilities.

Conclusion

In general, there is no clear pattern of empirical evidence on the relationship between bilingualism and cognitive flexibility in adults. There are some scattered data showing that speaking several languages may have cognitive advantages. However, most of this data is very recent, and no follow-ups have been conducted yet. The cross-cultural experience, although recognized as an important factor in bilingual development, has been virtually ignored in the empirical studies, possibly due to the fact that it is difficult to measure and relate to the individuals' cognitive functioning. However, both the level of expertise in both languages and the sociocultural context in which these languages were acquired might have an impact on the structural changes in bilingual memory (Kroll & de Groot, 1997). These modifications may explain the possible advantages of bilinguals compared to monolinguals in terms of their metalinguistic awareness and cognitive flexibility. Therefore, this study suggests that it is important to map individuals' cross-linguistic and cross-cultural experiences onto the functional changes that might take place in bilingual memory, and investigate what changes may be related to increase in cognitive flexibility which, as was hypothesized, may promote divergent thinking and creativity. In the following section, a discussion of empirical findings on the relationship between bilingualism and divergent thinking is presented.

Bilingualism and Divergent thinking

Positive influence of bilingualism on divergent thinking

Most empirical data in the field provide support for the positive influence of bilingualism on divergent thinking abilities (see Ricciardelli, 1992b, for a detailed overview). The majority of studies investigating the relationship between bilingualism and divergent thinking in children reported bilinguals' advantages over monolinguals on various divergent thinking tests (e.g., Cummins & Gulutsan, 1974; Kessler & Quinn, 1987; Ricciardelli, 1992a). However, most of these studies suffer from methodological drawbacks, in particular those related to selection of bilingual and monolingual participants (Reynolds, 1991).

Methodological problems with empirical studies in the field

Many studies on the relationship between bilingualism and creativity did not assess linguistic skills of participants when assigning them to bilingual or monolingual groups (e.g., Chorney, 1978; Gowan & Torrance, 1965; Torrance et al., 1970). For example, Chorney found a superior bilinguals' performance on measures of fluency, flexibility, and originality in the figural TTCT. However, the interpretation of these results in favor of bilingualism would be premature since participants' language proficiency in this study was not assessed. Similarly, Torrance and his colleagues did not specify what criteria they used to include Chinese-English and Malayan-English speaking children in the bilingual group. No scores of children's proficiency in two languages were obtained to ensure a bilingual-monolingual dichotomy (Hakuta, 1984). In Price-Williams and Ramirez's (1977) study, the participants' selection was based solely on their ethnic

group. Children attending Catholic parochial schools in Houston were included in the bilingual group if they were Mexican or African American assuming that they speak languages other than English.

Further, a number of studies in the field did not control for comparable language proficiency in both bilingual and monolingual groups (e.g., Carringer, 1974; Cummins & Gulutsan, 1974; Wang, 1982). For example, in Carringer's study, only bilinguals who scored high on the Word Association Test (used as a measure of language proficiency) in both languages were included in a bilingual group, whereas all others were included in a monolingual group. The results of this study favored bilinguals' superiority in divergent thinking. However, they are likely to be misleading, because the participants in the monolingual group were not adequately controlled for their linguistic abilities. Due to selection strategy, this group consisted of monolinguals (whose linguistic skills were not tested) and individuals who spoke more than one language, but their proficiency in one of these languages was low. Therefore, it is entirely possible that divergent thinking performance differences between bilinguals and monolinguals were in fact the differences in individuals with high and low language proficiency. To increase the content validity of this kind of studies, one should control for the language proficiency in both bilingual and monolingual groups.

Negative influence of bilingualism on divergent thinking

Several studies reported no positive influence of bilingualism on creativity. Whitney (1974) found no differences on the verbal TTCT between 12 and 14 years old German-English bilinguals and English monolinguals. In three other studies (Gowan & Torrance, 1965; Lemmon & Goggin, 1989; Torrance et al., 1970), monolinguals'

superiority was reported. For example, in Torrance et al.'s study, monolingual children in different grades outperformed their bilingual counterparts on fluency and flexibility in figural TTCT. In another study, Lemmon and Goggin found that Spanish-English bilinguals with low proficiency in Spanish as measured by the Picture Naming Test obtained lower scores on divergent thinking tests than English speaking monolinguals. In this study the performance of undergraduate bilinguals and monolinguals was compared on cognitive ability tasks that required concept formation, mental reorganization, abstract and divergent thinking, and mental flexibility. Monolinguals tended to show greater performance than bilinguals on most of the measures of cognitive skill, but subsequent comparisons of the monolingual with high and low bilingual subgroups (divided on the basis of their proficiency in Spanish) suggested that the effect was attributable to participants characterized as low bilinguals.

This potentially negative effect of bilingualism could be explained by a kind of threshold effect. Cummins (1976) introduced a theory that argues that the positive effects of bilingualism are not likely to be experienced until a minimum threshold of proficiency (age-appropriate) in both languages is achieved. Ricciardelli (1992a) tested this theory with Italian-English bilingual and English monolingual children and found that only those bilinguals who scored high on both English and Italian versions of the Peabody Picture Vocabulary Test (Dunn, 1965), showed superior divergent thinking abilities. Those bilinguals who had low proficiency in either one or both languages were statistically indistinguishable from the monolinguals. Ricciardelli argued that negative effects of bilingualism on creativity reported in those studies could be explained simply by bilinguals' poor linguistic fluency in one or both of their languages.

Between- vs. within-bilingual design in bilingualism research

As the previously reviewed studies indicate, one of the key problems in research on bilingualism and creativity is to establish a reliable measurement of bilingualism. At present, there are two major approaches dealing with this problem: between- and within-bilingual designs. The first design, used in most of the studies discussed so far, involves an overall comparison of bilinguals and monolinguals. The problem with this research design is that the criteria used to assign participants to bilingual and monolingual groups are often poorly specified and inconsistent from study to study. Moreover, individuals included in a bilingual group may have different levels of linguistic proficiency in each of their languages (e.g., MacNab, 1979), which consequently may have impact on their cognitive abilities.

A second type of design on the other side, uses a continuous measure in bilingualism assessment (e.g., Hakuta & Diaz, 1985; Konaka, 1997). This research design does not need to equate bilingual and monolingual groups. Bilinguals are grouped regarding different factors in bilingual development (e.g., level of expertise in both languages), which seems to tap into more subtle differences between different types of bilinguals. For example, Konaka determined the level of bilingualism based on the score computed from bilinguals' self-rating and the Word Association Test, which was subsequently transformed into a five-point scale ranging from balanced bilingual to unbalanced bilingual. She found that the degree of bilingualism significantly predicted divergent thinking abilities of Japanese sixth and seventh grade students living in New York area.

Thus, although most studies in the field used a direct comparison between bilinguals and monolinguals, the comparison between monolinguals and different types of bilinguals used in the within-bilingual design seems to be more plausible solution to studying the effect of bilingualism on human cognition.

Conclusion

To summarize, most reviewed studies on bilingualism and creativity involve group comparisons between bilinguals and monolinguals. These studies report that bilinguals tended to show more creative abilities than monolinguals. In the rare cases where monolinguals outperformed bilinguals, it was argued that the latter were not sufficiently fluent in either of their languages for cognitive advantages to occur. In addition, most of these studies suffered from various methodological drawbacks in bilingualism assessment.

To deal with the methodological problems, a within-bilingual design was proposed. In this design, the comparison is made not between bilinguals and monolinguals, but between different bilingual subgroups. This method seems to have a closer focus on the relationship between bilingualism and creativity, because potential differences found within bilingual group might indicate what factors in bilinguals' development influence their cognitive and creative abilities.

In addition, it is important to note that virtually all reported studies in the field were conducted with children and young teenagers. The focus was on the effect of bilingual development on cognitive growth. However, no studies examined the issue whether the benefits of bilingualism previously detected in childhood persist into adulthood when linguistic and conceptual systems are well established. The present study

examines the relationship between bilingualism and divergent thinking in adult population. The study employs a within-bilingual design with two carefully controlled independent variables: language proficiency and cross-cultural experience.

Present research

Why bilinguals may have advantages in divergent thinking performance

The creative cognition approach claims that creativity can be explained by enhanced normative cognitive functioning. One of the widely accepted mechanisms of normative creativity is divergent thinking, which is argued to benefit from increased cognitive flexibility. Thus, if bilingualism results in better cognitive functioning in the form of cognitive flexibility, then it follows that it should facilitate divergent thinking as well (Holtzman, 1980). Two factors in bilinguals' development (cross-linguistic and cross-cultural experiences) were hypothesized to facilitate their cognitive flexibility and divergent thinking abilities. This hypothesis is based on a line of logical reasoning about why bilinguals may have advantages in divergent thinking performance. Note, however, that these arguments are rather speculative and one of the objectives of this study was to test this hypothesis empirically.

Due to cross-linguistic experience bilinguals may learn to encode and access knowledge in diverse ways. The repeated switching from one language to another and constant 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 (e.g., Bialystok, 1988; Ianco-Worrall, 1972). Moreover, the specific structure of bilingual memory (Kroll & de Groot, 1997) 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).

Because of cross-cultural experience bilinguals might benefit from "two windows or corridors through which to view the world" (Okoh, 1980, p. 164). In other words, they can see the same phenomenon in two different ways and have two perspectives on the same situation. Because different cultural communalities 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). Cognitive flexibility and tolerance of ambiguity are considered as valuable traits of divergent thinking, because unrelated, often contradicting elements coexist during this process.

The present research objective

There is a long-standing discussion in the literature whether bilingualism has an effect on cognitive flexibility and creative abilities. A number of studies showed that bilingualism has a positive effect, however as noted above, most of these studies suffered from various methodological drawbacks. The purpose of this research was to present an improved methodology of bilingualism assessment to explore the factors in bilingual development that may influence creative abilities. The distinction was made between the effects of bilingualism and biculturalism on individuals' creativity. Bilingualism was assessed in terms of participants' proficiency in English and Russian, and biculturalism was assessed in terms of their cross-cultural experience. Divergent thinking abilities were used as an indicator of participants' creativity.

A study was conducted in which monolingual and different types of Russian-English bilingual participants with various degrees of experience with Russian and North American cultures were compared on divergent thinking tasks, which required 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, the tendency to produce ideas different from those of most other people, and the ability to think through the details of an idea and carry it out in both verbal and non-verbal domains.

This approach seems to provide finer distinctions between different types of bilinguals, which in turn made it possible to distinguish between the effects of cross-linguistic and cross-cultural experiences on individuals' divergent thinking. In contrast to most previously reported studies, college students participated in this research in order to determine whether the benefits of bilingualism previously detected in childhood persist into adulthood when linguistic and conceptual systems are well established.

Hypotheses

Several hypotheses were tested in this study.

(1) The virtue of speaking two languages has an effect on divergent thinking abilities independent of the cross-cultural experience. It was expected that language proficiency would have an effect on divergent thinking when the effect of cross-cultural experience is partialed out.

(2) If language proficiency per se has an independent effect on divergent thinking, there should be performance differences in individuals with different proficiency in both languages. In particular, it was expected that individuals highly proficient in both

languages would show greater divergent thinking abilities compared with the individuals moderately proficient in both languages.

(3) The virtue of experiencing and participating in two cultures has an effect on divergent thinking abilities independent of the cross-linguistic experience. It was expected that cross-cultural experience that accompanies language acquisition would have an effect on divergent thinking when the effect of language proficiency is partialed out.

(4) If cross-cultural experience per se has an independent effect on divergent thinking, it was expected that individuals who had extensive cross-cultural experience would show divergent thinking performance superior to that of individuals who had predominantly monocultural experience.

METHOD

Participants

The US sample

The participants in the US sample were Brooklyn College (BC) psychology students who participated for course credit. One hundred and eight immigrants from the former Soviet Union[3] who claimed to speak Russian and English (28 male and 80 female) aged between 16 and 39 (M=21.52, SD=4.54) were selected for the experiment. One hundred and four participants were born in the former Soviet Union, immigrated to the US at different ages (M=12.82, SD=7.27), and resided in the US for different time intervals (M=8.70, SD=5.39). Four participants were born in the US. However, all participants indicated that Russian was their L1. In addition, 47 American participants who reported being native monolingual English speakers (18 male and 29 female) aged between 16 and 51 (M=23.45, SD=8.96) were selected for the study. Five additional participants who did not complete the picture naming test, one participant who did not

[3] The choice of Russian-English bilinguals was made for two reasons. First, they were readily available in the Brooklyn College subject pool due to the large Russian immigrant community of Brooklyn. Second, the Russian and American cultures were assumed to constitute the apparent differences that might be reflected in participants' cross-cultural experience. This assumption is based on a number of studies reporting tremendous cultural differences with respect to the child's relationship to school, parents, and peers in the Russian and the American cultures (e.g., Bronfenbrenner, 1970; Horowitz & Kraus, 1984). Moreover, the acculturation studies show that these differences constitute the difficulties in cultural adaptations of the Soviet Union refugees in the US (e.g., Birman et al., 2002; Birman & Tyler, 1994) suggesting apparent differences in cultural values and norms in these two countries.

complete the ATTA, 20 monolingual participants who turned out to speak other languages (their self-rating language proficiency score for other languages exceeded 4 points, see the explanation below), and 13 monolingual participants who were born and lived in other countries were eliminated from the study.

Russian sample

The participants in the Russian sample were Moscow State University (MSU) linguistics and sociology students and Russian State University for the Humanities (RSUH) psychology students. One hundred and thirty Russian native speakers who indicated that they also spoke English (21 male and 109 female) aged between 16 and 32 (M=19.74, SD=2.78) were selected for the study. All of them were born in Russia and learned English at school and/or at the university.

Materials and assessment techniques

Background questionnaire

A biographical questionnaire (see Appendix A) was administered to determine participants' cultural background, when and how they learned English and Russian and the frequency and circumstances of language use. The questionnaire provided data that was used to assess participants' language proficiency and cross-cultural experience as outlined below.

The US bilingual participants received a questionnaire that provided data on each participant's educational background in Russia and the United States and their history of language acquisition. All Russian participants received a questionnaire of the same

format, in which all questions regarding the education in the US and history of L1 acquisition were eliminated and the questions regarding their residence in other countries were added.

Monolingual participants received a questionnaire of the same format as the US bilingual participants (see Appendix B), in which all questions regarding the cultural and linguistic experience with two languages were eliminated and two questions regarding participants' mastery of other languages and whether they had lived in other countries were added. Mastery of other languages was scaled on Likert-type 4-point scales (0 through 3) on which participants rated their abilities in reading, writing, speaking, and listening in the language other than English they speak the best, and a Likert-type 3-point scale (0 through 2) on which participants rated their ability to speak without an accent in that language. These questions were used to determine whether participants could be considered as truly monolingual. Those who scored more than 4 out of 14 on self-rating for other language or were born and lived in other countries for an extensive period of time were eliminated from the study.

Language proficiency assessment

Rationale

Traditionally, bilingualism has been evaluated in terms of four major language skills: speaking, writing, listening, and reading (Macnamara, 1969). One of the major problems in assessing bilingualism is to test all these skills in both languages (cf. Padilla & Ruiz, 1973). Therefore, various indirect measures of bilingualism, such as rating scales and tests of verbal fluency have been used (Macnamara, 1967, 1969). The present

experiment used two measures of linguistic ability, which were adaptations of conventional measures, such as self-rating scales and picture naming procedure.

Self-rating scales

The self-rating scales were included in the background questionnaire. Subject self-rating language proficiency scales consisted of five Likert-type scales for each language: four 4-point scales on which participants rated their abilities in reading, writing, speaking, and listening and a 3-point scale on which participants rated their ability to speak without an accent (see Appendix A). The total self-rating score ranged from 0 to 14 for each language.

In addition, participants were asked to rate their degree of bilingualism on a Likert-type 11-point Bilingual Balance Scale (BBS). Greater positive BBS scores indicated English linguistic dominance, greater negative BBS scores indicated Russian linguistic dominance, and zero score indicated bilingual balance.

Finally, the questionnaire had nine 3-point scales on which participants indicated their language preference in a variety of contexts including the language in which they think, dream, the one in which they prefer to read for pleasure, keep a diary, watch TV, understand jokes best, do mental arithmetic and tend to use with friends who share their bilingual skills. The sum of these indicators provided a language preference score; as before, greater positive values indicated a preference for English, greater negative values indicated a preference for Russian.

Picture naming test

Language proficiency was assessed 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), an improved version of Snodgrass and Vanderwart (1980), were arranged on four pages. The pages were then duplicated to make an eight-page booklet, with each picture appearing twice (see an excerpt of one page of the test in Appendix C). Responses were recorded in booklets with numbered lines corresponding to the pictures. Each participant was given 4 minutes to label in one language as many as possible of the 60 pictures on the first two pages and was given an additional 4 minutes to do the same task in the other language for the 60 pictures on the second two pages. The procedure was then repeated, with language order reversed. To prevent any language priming effect the order of languages was counter balanced across participants. 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 participant's label matched the corresponding item on the list, they scored 1 point, otherwise 0 point.

This procedure was used for participants speaking English and Russian. The same procedure was used for the English monolingual participants with the only difference being that they received only four pages with 120 pictures and had to name them only in English. As in the bilingual version, each response was scored either 1 or 0, so that the maximum number of points for picture naming in English was 120.

Language proficiency grouping criteria

A widely discussed issue in research on bilingualism is the notion that bilinguals are not a homogeneous population (e.g., Paradis, 1986). One of the methodological problems in many explorations of bilingualism is the neglect of control over the participants' proficiency in the languages studied. When people learn two languages their exposure to and training in each language is sometimes less intense than when they acquire only one language. As Lopez (1977) has pointed out, bilinguals do not always develop a high level of competence in one or both of their languages and may, in fact, be less skilled in their dominant language than monolingual counterparts. Researchers have tried to deal with this problem either by using longitudinal designs, which eliminate the need to equate different groups of participants (Hakuta & Diaz, 1985), or by using only participants who are demonstrably competent in the languages in which they were tested (Lemmon & Goggin, 1989).

This study adopted a different approach. Bilingual groups included individuals who were comfortably fluent in two languages as well as individuals who actively used, or attempted to use, more than one language, even if they had not achieved fluency in L2. The participants were grouped using a strategy of cutoff points similar to the selection criteria used in Lemmon and Goggin (1989). Participants who scored 75% (i.e., 90 out of 120) or above on both English and Russian versions of the Picture Naming Test (PNT) formed a "high proficiency" bilingual group (n=40). Those who scored above 25% (i.e., 30 out of 120) but below 75% on one version of the PNT and 75% or above on the other formed an "unbalanced proficiency" bilingual group (n=155). A third group included participants who scored above 25% and below 75% on both versions of the PNT and was

labeled as a "low proficiency" bilingual group (n=15). Finally, participants who scored 25% or less on either version of the PNT were grouped together with the participants who claimed to be monolingual and labeled as "monolingual" group (n=75). Note that all participants in this group scored above 75% on the PNT in their stronger language. Participants who scored 25% or less on the PNT in their weaker language were considered as monolingual, because although they claimed to speak more than one language their PNT score indicated that they virtually speak only one language. Thus, using the grouping criteria four language proficiency groups were obtained: a High Proficiency group including bilinguals who were highly proficient in both languages; an Unbalanced Proficiency group of bilinguals who were highly proficient in one language and moderately proficient in another; a Low Proficiency group including bilinguals who were moderately proficient in both languages; and a Monolingual group including participants who virtually spoke only one language.

Cross-cultural experience assessment

Rationale

This study was designed to test the hypothesis that bilinguals' cognitive functioning might be influenced by cross-cultural experience, which may bring an additional aspect to evaluation of bilingualism. Although there is agreement in the literature on the importance of including cultural exposure as a predictor for cognitive flexibility and creative abilities, there is no clear methodology on how to measure this component. Pavlenko (2000) argued that it is methodologically essential to take the degree of acculturation and biculturalism into consideration and distinguish bilinguals – regardless of their language proficiency and fluency – who acquired their L2 in a

decontextualized environment (e.g., in classroom setting) from those who acquired their L2 in environment where different cultural cues were available. Therefore, in the present study an attempt was made to disentangle the cross-cultural influence from the influence of speaking two languages by distinguishing between bilinguals who acquired both of their languages in a unitary cultural environment and bilinguals who acquired the two languages in different cultural environments. The cultural exposure coefficient was used to assess participants' cross-cultural experience.

Cultural exposure coefficient (CEC)

There is a strong argument in the 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; Marin, Sabogal, Marin, & Otero-Sabogal, 1987). For example, Tsai, Ying, and Lee (2000) reported that Chinese immigrants who came to the US early and late in life, responded differently to identity related questions. The early immigrants were barely exposed to their L1 culture and perceived their L2 culture as dominant. In contrast, the late immigrants were already preformed by the experience with L1 culture and therefore perceived their L2 culture through the prism of the former. It was assumed that the differences in the perception of the L1 and L2 cultural values might be rooted in the variations in cognitive functioning in individuals who were exposed to both cultures early or late in life. Therefore, it is prudent to measure the length and the age of individuals' cultural exposure to their L1 and L2 cultures since the frequency and recency of exposure to different cultural settings may have an impact on the cognitive system.

The CEC was introduced to reflect participants' age, age of immigration and the length of residence in the US and Russia. This coefficient 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 lived in the US (obtained from the length of residence in the US) by the participant's age. This coefficient is similar to an index previously used by Marin et al. (1987) and Tropp, Erkut, Coll, Alarcon, and Garcia (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 more unbalanced cultural exposure, with 1 representing monocultural individuals. In the same fashion, participants who were exposed to a new culture earlier had greater cultural exposure coefficient value than those who were exposed to a new culture later in life.

Assessment of Divergent thinking

In the studies of the relationship between bilingualism and creativity, the Torrance Tests of Creative Thinking (Torrance, 1966) have been used as the standard tools for assessing creative abilities. This study employed its adult version, the Abbreviated Torrance Test for Adults (ATTA, Goff & Torrance, 2002) that was used to assess participants' divergent thinking abilities.

Abbreviated Torrance Test for Adults

The test has three paper and pencil activities preceded by a written instruction that explained general guidelines and encouraged participants to use their imagination and thinking abilities. In the beginning of the test the participants were asked in what

language they prefer to do the test. As they preferred, the instructions were given either in English or in Russian. The English version of the instructions was from the original ATTA; the Russian translation was produced by the author who is a native speaker of Russian. The participants were encouraged to give verbal answers in the language that is more convenient for them.

In the problem identification task (Activity 1) participants were asked to suppose that they could walk on air or fly without being in an airplane or similar vehicle, and then to identify the troubles they might encounter. This activity provided verbal fluency and originality scores and five verbal responses. In the picture completion task (Activity 2) the participants were presented with two incomplete figures and were asked to draw as many pictures as possible with these figures (see Appendix D1). They were encouraged to make these pictures as unusual and communicating as interesting and as complete a story as possible. This activity provided figural fluency, originality, and elaboration scores. In the picture construction task (Activity 3) the participants were presented with a group of nine triangles arranged in 3x3 matrix and were asked to draw as many pictures or objects as they can using the triangles (see Appendix D2). Again, they were encouraged to make these pictures as unusual as possible. This activity provided figural fluency, originality, elaboration and flexibility scores. In addition, Activities 2 and 3 together provided 10 figural responses. Each activity was timed and lasted 3 minutes.

ATTA scoring procedure

The standard ATTA assessment consisted of four norm-referenced abilities (fluency, originality, elaboration, and flexibility) and two criterion-referenced creativity

indicators (verbal and figural) based on five verbal and 10 figural responses respectively (see Appendix E).

Fluency measured the ability to produce quantities of ideas which were relevant to the task instructions. The sum of fluency scores in all three activities provided a fluency raw score. Originality measured the ability to produce uncommon ideas or ideas that are totally new or unique. The sum of originality scores in all three activities provided an originality raw score. Elaboration measured the ability to embellish ideas with details. The sum of elaboration scores in Activities 2 and 3 provided an elaboration raw score. Finally, flexibility measured the ability to process information or objects in different ways, given the same stimulus. A flexibility raw score was obtained from Activity 3. Further, the raw scores for fluency, originality, elaboration, and flexibility were transformed into scaled norm-referenced scores by the recommended procedure (Goff & Torrance, 2002) which took age-related norms into account. Appendix F presents examples of the responses that were rated with the highest scores on originality, elaboration, and flexibility.

In addition, a verbal criterion-referenced creativity indicators score was computed as a sum of five verbal responses in Activity 1 (e.g., humor and conceptual incongruity, future orientation, provocative questions); and a figural criterion-referenced creativity indicators score was computed as a sum of 10 criterion-referenced creativity indicators assessed in Activities 2 and 3 (e.g., resistance to premature closure, internal visual perspective, richness and colorfulness of imagery).

Then, a creativity index was computed as a sum of four norm-referenced and two criterion-referenced creativity indicators scores. The creativity index represented a composite measure of overall creativity.

Inter-rater reliability

Two independent raters evaluated the ATTAs. The first one rated the ATTAs in the US sample and the second one rated the ATTAs in the Russian sample. Both raters were English-Russian bicultural bilinguals fluent in both languages and familiar with both American and Russian cultural cues. This caution was taken to ensure that both raters fully understand participants' answers on both English and Russian versions of the ATTA. The following procedure was used to train the raters. After reading the standard rating instructions (Goff & Torrance, 2002) each rater was given 10 randomly selected tests. Their ratings were inspected, and necessary corrections to their rating strategies were applied. To ensure inter-rater reliability, a correlational analysis of their ratings was performed. Fifteen randomly selected cases from the US sample were rated by both raters, and their creativity index ratings were compared. There was found a strong correlation (r=.81, p<.001) between the creativity indexes provided by the first rater (M=72.80, SD=8.55) and the second rater (M=73.00, SD=8.83). Therefore, it was concluded that both raters used the same rationale and their ratings were comparable.

The reliability and validity of the ATTA

The ATTA has been fully normed and its validity assessed. The norms reported in the ATTA manual are based upon adults who had completed the D-TTCT prior to the year 2000. The manual reports the Kuder-Richardson (KR21) reliability coefficient for

the total raw score for the four creative abilities measured by the ATTA as .84, and for the total raw score with the creativity indicators score as .90. Inter-rater reliabilities range from .95 to .99.

Another question that could be raised concerns the extent to which the ATTA is a culture-free and culture-fair test. Undoubtedly, this test has certain elements that reflect the culture of its developers, as does virtually every psychometric instrument in use today. However, as was noted above, the earlier version, the TTCT, has been used in a variety of cultures and with individuals speaking a number of different languages (see Saeki, Fan, & Van Dusen, 2001). However, so far as can be determined, there has been no systematic study on the culture-fairness of this test reported in the literature. There is no reason to suspect any cultural biases with Russian and American individuals since the TTCT was found to be reliable in different cultural and linguistic contexts in the previous studies.

Procedure

After being introduced to the purpose of the experiment, participants were given the background questionnaire. After the questionnaire was filled out, the experimenter collected it and provided participants with the Picture Naming test. After a short break, the participants were given the Abbreviated Torrance Test for Adults, which was introduced as a test of "thinking up new ideas and solving problems". Both tests were paper and pencil tests; the tests were timed. Standard instructions preceded the tests, and the response protocols were collected after each test was completed.

Results and discussion

Divergent thinking measures

Four norm-referenced ATTA measures obtained from the standard scoring procedure were used to assess participants' divergent thinking abilities. The first three columns of Table 1 present the intercorrelations among these measures. The correlations among the creativity measures were factor analyzed[4] using the principal component method with varimax rotation. SPSS FACTOR extracted two factors, which accounted for 68.84% of the variance. Loadings of the measures on these factors appear in the last two columns of Table 1, with the highest loading italicized. Factor I is determined primarily by the measures of fluency and flexibility. This factor thus appears to represent the ability to generate various solutions to a problem. The second factor seems to represent innovative thinking with the highest loading on the originality.

These two factors are used to facilitate the interpretation of participants' performance on four ATTA measures. Thus, the four traits of divergent thinking seem to represent two types of creative behavior. The first type addresses the ability to generate various, often unrelated, ideas. The second type of creative behavior addresses the ability to generate novel and unique ideas.

[4] Although the divergent thinking measures were normed (see Goff & Torrance, 2002), the factor analysis was used to see how these four traits relate to each other.

Table 1: The Pearson correlations and factor loadings for the norm-referenced creativity measures.

Measure	Creativity measures			Factor loadings	
	2	3	4	I	II
1. Fluency	.23***	.28***	.47***	*.76*	.42
2. Originality		.14*	-.10	-.15	*.86*
3. Elaboration			.10	.31	.57
4. Flexibility				*.89*	-.15

* $p < .05$, ** $p < .01$, *** $p < .001$

Language proficiency and cross-cultural experience

The major purpose for the various measures of linguistic skills used was to provide a basis for discriminating between participants who form different language proficiency groups. However, the usefulness of the self-ratings and the picture naming test as assessment tools of language proficiency in bilinguals was also considered. Table 2 gives the intercorrelations among the PNT, self-rating and BBS scores and the language preference score in a variety of contexts. All correlations were significantly high (all *p*s<.001) suggesting that participants were able to give a good estimate of their linguistic proficiency by evaluating their abilities in four major language skills and to speak without an accent in English and Russian as well as by estimating the degree of their bilingual balance. The strong correlations between various measures of language proficiency suggested that the English and Russian PNT scores could be safely used for

the language proficiency grouping based on criteria specified earlier (see "Language proficiency grouping criteria" section).

Table 2: The Pearson correlations for the language proficiency measures of bilingual participants.

Measure	2	3	4	5	6
1. Picture Naming Test English	-.51***	.76***	-.50***	-.67***	.66***
2. Picture Naming Test Russian		-.58***	.82**	-.77***	-.82***
3. Subject self-rating score for English			-.47***	.72***	.67***
4. Subject self-rating score for Russian				-.80***	-.84***
5. Subject self-rating on the BBS					.85***
6. Language preference					

** $p < .01$, *** $p < .001$

Recall that the purpose of this study was to tease apart the effects of bilingualism and biculturalism and to examine their influence on divergent thinking. Language proficiency was found to be significantly associated with the CEC ($F(3, 281)=33.68$, $p<.001$, $\eta^2=.26$). As Table 3 shows, the Monolingual and Unbalanced Proficiency bilingual groups had significantly higher CEC values than the High and Low Proficiency bilingual groups (all $ps<.001$). In other words, Monolinguals and Unbalanced Proficiency bilinguals tended to be culturally unbalanced whereas the High and Low Proficiency bilinguals tended to be culturally balanced. Therefore, to examine the effect of language proficiency on divergent thinking above and beyond the effect of the cross-cultural experience, an analysis of covariance was performed.

Table 3: Mean scores, standard deviations, and group sizes of the PNT in English and Russian and the CEC for monolingual and bilingual groups.

Measure		Monolingual*	Bilingual		
			High	Unbalanced	Low
PNT English	M	109.85	100.15	71.59	74.00
	SD	8.66	6.77	21.96	10.18
	N	52	40	155	15
PNT Russian	*M*	118.6	107.54	98.50	67.20
	SD	1.71	7.99	26.69	20.21
	N	23	40	155	15
CEC	*M*	.98	.51	.78	.44
	SD	.11	.35	.31	.30
	N	75	40	155	15

* The English PNT score for the monolingual group is given for the monolinguals in the US sample whereas the Russian PNT score is given for the monolinguals in the Russian samples.

Language proficiency on divergent thinking

A MANCOVA was performed on four dependent variables associated with the norm-referenced divergent thinking measures, the CEC as covariate, and language proficiency as the independent variable. With the use of Wilks' criterion, the combined dependent variables were significantly related to the language proficiency ($F(12, 733)=5.98, p<.001, \eta^2=.08$) and the cultural exposure coefficient ($F(4, 277)=2.56, p<.05$,

η^2=.04). After adjustment for the CEC, the univariate analysis revealed a significant main effect of language proficiency on the measures of fluency ($F(3, 280)=20.69$, $p<.001$, η^2=.18) and elaboration ($F(3, 280)=6.15$, $p<.001$, η^2=.06). These finings show that when the effect of biculturalism is partialed out, bilingualism has an impact on the ability to rapidly produce a large number of ideas or solutions to a problem (fluency) and to think through the details of an idea and carry it out (elaboration).

How language proficiency may facilitate divergent thinking

To carefully examine the specific characteristics of bilingualism that promote these divergent thinking abilities, a Tukey HSD post-hoc analysis was performed. Table 4 shows the mean norm-referenced divergent thinking scores and standard deviations for the monolingual and four bilingual groups. The analysis revealed that the High Proficiency bilinguals significantly outperformed the Low Proficiency bilinguals and the Monolinguals on the measures of fluency (mean difference (ΔM) =2.14, $p<.01$ and ΔM=1.44, $p<.01$ respectively) and elaboration (ΔM=1.82, $p<.05$ and ΔM=1.28, $p<.05$ respectively), and the Unbalanced Proficiency bilinguals outperformed the Low Proficiency bilinguals and the Monolinguals on the measures of fluency (ΔM=2.77, $p<.001$ and ΔM=2.06, $p<.001$ respectively) and elaboration (ΔM=1.35, p=.09 and ΔM=.82, $p<.05$ respectively). The Low Proficiency bilinguals performed similarly to the Monolinguals on both of these measures (ΔM=-.71 for fluency and ΔM=-.53 for elaboration, both ps>.10). The High Proficiency bilinguals performed similarly to the Unbalanced Proficiency bilinguals on both of these measures (ΔM=-.63 for fluency and ΔM=.47 for elaboration, both ps>.10).

Table 4: Mean scores and standard deviations (in parentheses) of the norm-referenced divergent thinking measures for monolingual and bilingual groups.

Measure	Monolingual	Bilingual			Total
		High	Unbalanced	Low	
Fluency	14.44 (2.35)	15.88 (2.30)	16.50 (2.11)	13.73 (2.25)	15.73 (2.41)
Originality	15.92 (2.14)	16.35 (2.18)	16.25 (2.23)	15.00 (2.80)	16.11 (2.24)
Elaboration	15.87 (2.31)	17.15 (1.88)	16.68 (2.08)	15.33 (2.35)	16.46 (2.18)
Flexibility	14.81 (2.43)	15.55 (2.47)	15.43 (2.08)	14.93 (2.02)	15.26 (2.24)
N	75	40	155	15	285

These findings demonstrate that the main effects of the language proficiency on the fluency and elaboration measures could be explained by the superior performance of the High and Unbalanced Proficiency bilinguals over the Low Proficiency bilinguals and Monolinguals. In other words, bilinguals highly proficient in at least one language outperformed the bilinguals who had moderate proficiency in both languages and the individuals who spoke only one language. Moreover, the Low Proficiency bilinguals tended to score similarly to the Monolinguals on these measures. This suggests that inability to achieve fluency in both languages put these individuals at the same disadvantage as the monolingual individuals.

Cross-cultural experience on divergent thinking

To explore whether the CEC is related to divergent thinking performance when the effect of the language proficiency is controlled for, a partial correlational analysis was

carried out. To correct for the fact that the language proficiency measure is categorical, a composite PNT score was computed as a proportion of the absolute difference between the English and Russian PNT scores and a sum of these scores (a procedure similar to one used by Cummins & Gulutsan, 1974). A smaller composite PNT score indicated greater language proficiency and greater bilingual balance[5].

A partial correlational analysis with the CEC and four norm-referenced divergent thinking measures controlling for the composite PNT score revealed a significant positive correlation between the CEC and the measures of fluency (r=.23, p<.001, df=282), originality (r=.13, p<.05, df=282), and elaboration (r=.12, p<.05, df=282)[6]. The positive

[5] The language proficiency groups were found to have significantly distinct PNT composite scores ($F(1, 136)$=285.00, p<.001, adjusted R^2=.55). The High and Low Proficiency groups had the lowest composite scores (M=.06, SD=.04 and M=.16, SD=.14 respectively, ΔM=-.10, p<.01), the Monolingual group had the highest (M=.68, SD=.10) and the Unbalanced Proficiency group had the medium PNT composite scores (M=.30, SD=.12). All mean differences were highly significant (ps<.001). Note, however, that this score fails to distinguish between individuals with high and moderate proficiency in both languages if the absolute difference between the English and Russian PNT scores was relatively small. In this case, the linguistic balance was likely to compensate for the linguistic fluency and produced similar composite PNT scores. For example, Case 41 had an English PNT score of 83 and a Russian PNT score of 85, which produced a composite PNT score of .01. The same score was produced in Case 110 with English PNT score of 102 and Russian PNT score of 104. Although both of these participants were balanced in both their languages, the latter had high proficiency whereas the former had moderate proficiency in these languages. Therefore, the composite PNT score could be used only as an exploratory variable.

[6] To account for the fact that composite PNT score used in this analysis failed to distinguish between different types of bilinguals in cases when the linguistic balance compensated for the linguistic fluency, two additional partial correlational analyses between the CEC and four norm-referenced divergent thinking measures were performed. The first analysis was controlling for the bilingual balance represented by the absolute difference between the English and Russian PNT scores. The second one was controlling for the language proficiency represented by the sum of these two scores. Both analyses produced results similar to the one that used the composite PNT score. They revealed a significant positive correlation between the CEC and fluency (r=.20 and r=.16 for first and

correlations suggested that when the language proficiency effect was partialed out, participants who had experienced mostly one culture tended to have greater abilities in fluency, originality, and elaboration compared with those who had more cross-cultural experience.

Conclusion

Overall, the findings of this study suggest several possibilities concerning the links between bilingualism, biculturalism and creativity. First, bilingualism was found to have a positive influence on divergent thinking above and beyond the effect of biculturalism.

Second, bilinguals highly proficiency in at least one language were found to have greater abilities for rapid production of a large number of ideas or solutions to a problem and thinking through the details of an idea and carry it out, whereas bilinguals with poor linguistic skills in both languages seemed to lack these abilities. These findings suggest that there are cognitive processes involved in divergent thinking that might be facilitated by bilinguals' linguistic skills. However, the small size of language proficiency effect raises the possibility that other factors in bilingual development such as intelligence, education, motivation (not controlled in this study) might have had an impact on these processes.

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second analysis respectively, both *p*s<.01, *df*s=282) and originality (*r*=.12 and *r*=.14 for first and second analysis respectively, both *p*s<.05, *df*s =282), and positive correlation approaching significance between the CEC and elaboration (both *r*s=.10, *p*s=.09, *df*s=282).

Third, the exploratory analysis of the relationship between biculturalism and divergent thinking when the effect of bilingualism was partialed out showed a tendency for the cross-cultural experience to have a negative influence on fluency, originality, and elaboration in divergent thinking. This finding fails to support the initial hypothesis of this study that culturally balanced individuals would outperform their culturally unbalanced counterparts due to highly developed cognitive systems that might facilitate their divergent thinking. In contrast, it suggests that some cognitive structures were underdeveloped in participants in this study due to the fact that they lived for extensive periods of time in both countries. A more detailed discussion of each of these findings is presented in the following section.

GENERAL DISCUSSION

This study can be placed in a theoretical framework of the creative cognition approach (Ward, Smith, & Finke, 1999) which argues that creativity may result from normative human cognition. In this framework, bilingualism and biculturalism were hypothesized to encourage divergent thinking and cognitive flexibility, which together facilitate creative thought. It was hypothesized that bilinguals' cross-linguistic and cross-cultural experiences influence their cognitive functioning, which in turn may facilitate their divergent thinking. The objective of the study was to explore what parts of human cognition could be influenced by these factors in bilingual development. Thereby, it was hypothesized that a positive effect of bilingualism on cognitive functioning reported in the literature could possibly be explained by an effect of cross-cultural experience often accompanying acquisition of different languages. This argument addresses a long-standing discussion in the literature on defining bilingualism (Ardila, 1998), in particular, what factors in bilingual development determine the variations in bilinguals' cognitive functioning.

The findings of the study showed that both factors in bilinguals' development might be related to their cognitive abilities. In particular, the results showed that bilinguals' linguistic skills are related to the ability to rapidly produce a large number of ideas or solutions to a problem (fluency) and to think through the details of an idea and carry it out (elaboration). Bilinguals' experience with two cultures was shown to relate to the fluency and elaboration in divergent thinking as well as to the ability to generate novel and unique ideas (originality). Although these findings present no clear systematic pattern of results, they lend support to the appealing argument in the literature that

bilingualism should be studied not only in the context of individuals' linguistic abilities, but in the sociocultural context as well (e.g., Appel, 2000; Ervin-Tripp, 2000; Pavlenko, 1997).

The following sections present a detailed discussion of the effects of language proficiency and cross-cultural experience on divergent thinking. The purpose of this discussion is to attempt to specify the cognitive mechanisms that, on one side, might be facilitated by these factors in bilingual development and, on the other, are responsible for bilinguals' divergent thinking performance. The ultimate goal of this discussion is to shed some light on the underlying mechanisms in divergent and creative thinking in general.

The effect of language proficiency on divergent thinking

The hypothesis that bilinguals would outperform monolinguals on the tests requiring cognitive flexibility, in particular the tests of divergent thinking abilities, was partially derived from previous research with children that reported a bilingual advantage on tests of cognitive and creative skills (see Ricciardelli, 1992b, for a review). Similar results were anticipated in the adult population under the assumption that the advantages of bilingual development should pass into adulthood. This study at least partially confirmed these expectations. Bilinguals who were highly proficient in at least one language outperformed monolinguals on fluency and elaboration in divergent thinking. However, the bilinguals who performed less well on tests of linguistic skills in either of the language studied tended to score similar to the monolinguals on these measures.

The poor performance of the Low Proficiency bilinguals could be explained by the fact that some of the ATTA measures were obtained in verbal activities. Therefore, individuals with limited expertise in both languages could be at a disadvantage. This

explanation, however, is not satisfactory for two reasons. First, the Low Proficiency bilinguals scored lower than the High and Unbalanced Proficiency bilinguals on the elaboration measure, which was obtained in figural activity only. Secondly, the former showed no performance difference with the latter on the originality measure, which was partially based on the score in verbal activity.

The other reason for the Low Proficiency bilinguals to perform lower than the other bilingual groups might relate to the bilinguals' cognitive development. Cummins (1979) argued that bilingualism may have a negative impact when the child cannot fully benefit from educational experiences because of inadequate language competence. He notes that, in early grades, this difficulty may not be obvious because cognitive development is less dependent on language; later development, however, increasingly depends on literacy skills in order to gain proficiency in using the cognitive functions of language. Thus, the difference in divergent thinking performance between bilinguals with lower and higher linguistic skills may reflect the possible relationship between the type of bilingual background and cognitive development.

Further, the study shows that bilinguals do not need to reach an ultimate level of expertise in both languages to show superior divergent thinking performance: no performance differences were found between the High and Unbalanced Proficiency bilinguals and both groups obtained higher fluency and elaboration scores than the Monolinguals. This finding is in line with those in Bialystok's (1988) two studies in which monolingual and bilingual children differing in their level of bilingualism were given metalinguistic problems that made demands on either analysis of knowledge (i.e., the way in which the language is represented in the mind) or control of processing (i.e.,

the selection of information for use). She found that bilingual children performed better than monolingual children on metalinguistic tasks requiring high levels of control and analysis. These findings suggest that higher cognitive abilities benefit from metalinguistic awareness promoted by bilingualism in that bilinguals, compared with monolinguals, have more elaborated representation of knowledge and are more aware of what information needs to be selected.

Furthermore, the findings of this study fail to replicate a number of other studies in the field that revealed advantages of highly proficient bilinguals on the various divergent thinking measures compared with linguistically unbalanced bilinguals (e.g., Carringer, 1974; Konaka, 1997). For example, Konaka found that linguistically balanced bilingual children outperformed their linguistically unbalanced counterparts on the measures of fluency, flexibility, and originality. However, the procedure used in her study to distinguish between bilingual groups is unlikely to measure linguistic skills. The word association test (used by Cummins & Gulutsan, 1974; Peal & Lambert, 1962; Wang, 1982) was employed to determine participants' linguistic abilities. On this test, given a word in one or another language, participants had to report as many association as they could. The number of responses produced in each language was used to assess the degree of their balance in two languages. This procedure seems to assess participants' fluency in divergent thinking (ability to generate associations) rather than their linguistic skills. Not surprisingly, this study showed a high correlation of this measure with the divergent thinking measures.

The relationship between cross-cultural experience and divergent thinking

It is a well-known fact that language acquisition is often accompanied by the adaptation of new cultural values. However, this cultural element has been virtually completely ignored in the study of the possible cognitive impacts of bilingualism. This study explored the possibility that bilingual individuals who participate in two cultures may acquire cross-cultural experience that would facilitate their divergent thinking. The length of residence in the US and Russia was used in this study to assess individuals' cross-cultural experience. The obtained results, however, failed to support this prediction. Culturally balanced individuals tended to show poorer performance on fluency, originality, and elaboration in divergent thinking compared with their culturally unbalanced and monocultural counterparts.

Several alternative, although not necessarily mutually exclusive, explanations can be advanced for these findings. First, the cultural exposure coefficient used in this study as a measure of the cross-cultural experience could in fact be insensitive to the variations in the cross-cultural environment and its psychological ramifications that might have an influence on individuals' divergent thinking (this point is pursued in more details below).

Second, the finding of the negative relation between the cross-cultural experience and divergent thinking may be explained by the specificity of cultural experience of participants in this study. A number of studies argued that bilinguals undergo conceptual changes due to experience with different cultural and linguistic environments (e.g., de Groot, 2000; Pavlenko, 2000). This study hypothesized that these 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 the concepts

(Pavlenko, 2000). The hypothesis was based on the assumption that bicultural individuals acquire the values and norms of the new as well as original cultures, which allows them to perceive a variety of events from different culture-specific perspectives. However, it is entirely possible that the participants in this study who were assumed to have bicultural experience in fact had a subcultural one[7]. 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 inability to fully acquire the knowledge of a new culture. In other words, it might be speculated that because of the subcultural experience participants in this study underwent those conceptual changes that resulted in poorly developed conceptual system. As a consequence, the underdeveloped conceptual system could be the reason why participants with subcultural experience showed poorer performance on divergent thinking tasks comparing with their monocultural counterparts.

Finally, it is entirely possible that the cross-cultural experience is not related to divergent thinking abilities at all, and the differences in divergent thinking performance between culturally balanced, culturally unbalanced and monocultural participants should be explained by other factors not accounted for in this study (e.g., intelligence).

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[7] 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.

It is important to note however, that this study was rather exploratory and only one definite conclusion can be advanced from its results: the psychological ramifications of the experience with two cultures in individuals' behavior should be considered from both the cognitive and sociocultural perspectives. The findings about the relationship between cross-cultural experience, its impact on conceptual system, and the consequences of this impact on divergent thinking open a new line of research on biculturalism that should bring together the conjoint efforts of cognitive and social psychologists.

What cognitive processes underlying divergent thinking might be influenced by bilingualism?

The majority of the studies in the field reported a positive effect of bilingualism on creative abilities (see Ricciardelli, 1992b). Most of these studies were conducted with children whose creative abilities were tested with the TTCT. These studies reported bilinguals' advantages on variety of divergent thinking traits such as fluency (e.g., Carringer, 1974; Ricciardelli, 1992a), elaboration (e.g., Srivastava & Khatoon, 1980), originality (e.g., Konaka, 1997; Okoh, 1980), and flexibility (e.g., Carringer, 1974; Konaka, 1997). These findings might suggest that bilinguals should be more creative than monolinguals. However, this notion seems to be at odds with geography. If bilingualism itself has a direct impact on the invention of truly creative products, we would expect to see substantially more creative production among the residents of bilingual or multilingual countries such as Canada, Belgium, or Switzerland. This appears not to be the case. Thus, the findings that bilingualism has positive influence on creative abilities should not be interpreted as if bilinguals are more creative than monolinguals.

The findings suggest that although bilingualism might have an influence on creativity, this influence is indirect. That is, bilingualism is argued to 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, expertise, motivation, personal experience, etc.) play a dominant role.

Thus, this study explored possible cognitive processes that may be facilitated by bilingualism and how these processes are related to divergent thinking and creative abilities. It was shown that the degree of language proficiency in bilinguals had an effect on the fluency and elaboration in divergent thinking, but had no influence on the originality and flexibility traits. These four traits of divergent thinking were grouped together as two types of creative behavior: (a) the ability to generate various, often unrelated, ideas and (b) the ability to generate novel and unique ideas. The first type seems to represent characteristics of the creative *processes*, i.e. the ability to activate a multitude of unrelated concepts and work through the concepts already activated. However, it does not imply that the ideas based on these concepts should be necessarily original (i.e. satisfy the criteria of novelty and utility) and result in creative production. On the other side, the second type of creative behavior may account for originality, i.e. the ability to produce innovative and useful ideas. This type therefore, is oriented towards the *product* of creative processes. This study assumes the functions of the first category as 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 late cycle capacity in Mumford, 2000)

during which the original ideas could 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 should provide a larger pool of ideas to work with thereby contributing to the production of more original products (Simonton, 1998). However, other individual cognitive capacities might play here a more important role.

The findings of the study demonstrated that bilinguals highly proficient in at least one language showed greater divergent thinking performance on the measures of fluency and elaboration compared with monolinguals. However, those bilinguals who were not able to achieve high proficiency in any of their languages showed divergent thinking performance on these measures similar to monolinguals. Finally, there were no performance differences between bilinguals and monolinguals on originality in divergent thinking. All together, these findings suggest that if bilingualism facilitates divergent thinking, it might function to increase the basic cognitive processes responsible for generating a multitude of unrelated ideas and working through ideas already generated, but not facilitate the extraction of truly original ideas. Moreover, these processes might be facilitated only if bilingual individuals have reached high proficiency in at least one language.

Speculating about these findings, bilinguals comparing to monolinguals might develop and/or utilize to a greater extent cognitive mechanisms that are responsible for simultaneous activation and elaboration of a multitude of often unrelated concepts. This virtue manifested itself in bilinguals' greater scores on fluency and elaboration measures of the ATTA. Further, the finding that only bilinguals who were highly proficient in at least one language showed greater divergent thinking performance compared with

monolinguals hints at the possibility that these cognitive mechanisms are language related. All together, bilinguals may employ cognitive mechanisms that on one side facilitate concept activation, and on the other side, are language related. One of the possible logical conclusions could be that these mechanisms might operate between conceptual and lexical representations in bilingual memory. Thus, the questions to be answered in future studies should focus on: (a) the nature of the processes that facilitate divergent thinking, and (b) the inherent properties of bilingual memory that allow bilinguals to develop or utilize these processes to a greater extent.

The following section presents a discussion in attempt to answer these questions: how the architecture of bilingual memory may facilitate the cognitive processes that might be responsible for increase in simultaneous activation and processing of unrelated concepts.

Architecture of bilingual memory that might facilitate divergent thinking

This discussion is based on several assumptions about the architecture of bilingual memory that remain the topics of heated debates in the literature. Bilingual memory is assumed as a dynamic system with at least two levels of processing: conceptual and lexical. The conceptual level is assumed to be language independent (Paradis, 2000) and to consist of a large set of mutually linked conceptual units organized in conceptual networks (Lamb, 1999). The lexical level is assumed to have lexical units representing two lexicons corresponding to each of bilinguals' languages. Both lexicons are assumed to have direct access to the shared conceptual system so that the units in the two lexicons

can communicate through a set of shared conceptual units[8] (a notion similar to the distributed lexical/conceptual feature model of bilingual memory of Kroll & de Groot, 1997). Further, each lexicon contains language specific units, but the activation in one lexicon inevitably causes the activation in another through a set of shared lexical units[9] (see Smith, 1997, for a discussion of this view). The spreading activation is assumed as a communication mechanism between the lexical and conceptual levels.

Several properties of bilingual memory follow from these assumptions. First, because of the distributed nature of this model, the same conceptual units may be a part of the representation of different concepts. For example, a concept CAT shares a set of features with a concept DOG (e.g., '4 paws', 'tail', 'animal', etc.). However, these two concepts differ in some features that are unique for each of them (e.g., 'bark' unit for the DOG, and 'meow' unit for the CAT). Second, the translation equivalents in L1 and L2 lexicons activate each other through the corresponding conceptual units. For example, a word "cat" in English and its German translation equivalent "die Katze" share the same set of conceptual units (such as '4 paws', 'tail', 'animal', 'meow', etc.) that mediate between entries in two lexicons. However, there are language-specific conceptual units that can be directly accessed through one language only (e.g., the figurative meaning of

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[8] This view was developed in a long-standing debate in the literature as to whether the communication between lexicons occurs through word association or through concept mediation (see Kroll & de Groot, 1997, for an overview).

[9] This integrated lexicon approach to the bilingual memory (Dijkstra & van Heuven, 1998; Grainger & Dijkstra, 1992) was developed in another discussion in the literature about how two lexicons in bilingual memory are connected to the conceptual system. An alternative view advocates a language-specific access system in which both languages are stored separately and access conceptual system independently of each other (Gerard & Scarborough, 1989; Soares & Grosjean, 1984).

the word "cat" as in "cat burglar", or the figurative meaning of the word "Katze" as in "die Katze im Sack kaufen" [to buy a pig in a poke]). Third, the spreading activation mechanism works as following. A word in L1 activates corresponding lexical units in L1 lexicon, which, in turn, activate the corresponding conceptual units. The conceptual units send a partial activation back to L2 lexicon, which consequently activates the corresponding L2 lexical units. Since the L2 word is not an identical translation of L1 word, the activation of the L2 lexical units results in the activation of some additional conceptual units that were not activated during L1 word presentation. These units send the partial activation to other words, which do not have a direct relation to the L1 word (see Paradis, 1997, for a similar view).

This study suggests that, in addition to activation of conceptual units by means of associations (as it takes place in monolingual memory), bilingual memory permits broad language mediated concept activation. That is, activation flow on the conceptual level mediated by the lexical level establishes the links between distant conceptual units[10]. In the previous example, the presentation of the word "cat" in English is likely to activate conceptual units that represent the literal meaning of CAT as well as the conceptual units that represent its alternative meanings such as the one in the "cat burglar". In addition, the common set of activated conceptual units triggers the German lexical units for "die Katze" that in turn activate all related conceptual units, including those representing "die Katze im Sack kaufen". Accordingly, the latter send the activation back to the lexical

[10] The language mediated concept activation might also occur in the monolingual memory by means of the lexical associations between the words with similar lexical properties (e.g., rhymes). However, this study argues that the language mediated associations in bilingual memory permit the activation of more distant concepts.

level and activate lexical units corresponding to the idiom "to buy a pig in a poke" in English. Therefore, among the others, lexical units representing a word "pig" will be activated and in turn, trigger its corresponding conceptual units. As a result, a large pattern of conceptual units will be activated that allows distant and unrelated concepts such as BURGLAR and PIG to be explored simultaneously[11].

This is an important characteristic of bilingual memory that may assist bilinguals in simultaneously activating a set of often unrelated concepts to a greater extent than in monolinguals. Thereby, bilinguals' greater performance on fluency and elaboration in divergent thinking is called forth. Thus, answering the questions introduced at the end of the previous section, the spreading activation mechanism might be one possible candidate for cognitive processes underlying divergent thinking. This mechanism may be facilitated in bilinguals because of distributed representation of conceptual and lexical units of information and dual lexical access in bilingual memory. However, it is important to keep in mind that the greater ability to simultaneously activate distant concepts and keep them active during the thought process does not necessarily result in finding the creative

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[11] In this approach, more abstract words are more likely to activate more distant concepts because they share fewer conceptual features. This notion is in line with a model of structural alignment (Markman & Gentner, 1993) that suggests that similar pairs have compatible structures, which can be merged easily, and consequently these pairs evoke little involvement of information outside the target concepts. In contrast, dissimilar pairs are less readily aligned and foster search beyond the target concepts to find the contrasting properties in their structures. The search outside the given boundaries leads to the activation of new concepts, which might result in emergence of new properties. This model was tested by Wilkenfeld (1995) who asked participants to provide two different definitions for combinations of similar (e.g., guitar – harp) and dissimilar (e.g., motorcycle – carpet) concepts and to list attributes of the distinct and shared concepts. This task required comparing and contrasting of the given concepts. She found that dissimilar pairs resulted in emergence of more unpredictable properties.

solution. It may assist bilinguals in finding novel, useful, and original solutions and ultimately result in a truly creative product, but other factors in individuals' development (such as intelligence, education, motivation, personal experience, etc.) may have priority in the influencing these processes.

Alternative view: No relationship between bilingualism and divergent thinking

The discussion presented above assumes that the architecture of bilingual memory stimulates certain cognitive processes that facilitate divergent thinking in bilinguals. This assumption is based on the findings of bilinguals' superiority over monolinguals on some of the divergent thinking measures of the ATTA. However, it is entirely possible that the correlation between bilinguals' language proficiency and their divergent thinking performance found in this study has no causal relation. That is, the same cognitive mechanisms that facilitate divergent thinking may also assist bilinguals in language learning. This argument is in line with the finding that bilingual participants who failed to reach high level of linguistic proficiency in either of their languages showed divergent thinking performance similar to their monolingual counterparts.

Thus, the alternative interpretation of the results may be proposed: participants with superior cognitive abilities were able to master high linguistic skills as well as obtain high scores on the divergent thinking test. The superior cognitive abilities could result from other factors in individual's development, such as intelligence, education, motivation, personal experience, etc. In this view, there is no influence of bilingualism on divergent thinking, but the linguistic and divergent thinking abilities are facilitated by the same cognitive functions. What underlying cognitive mechanisms both of these skills have in common is a question to be answered in future studies.

Bilingualism and biculturalism assessment problems

Bilingualism is pervasive throughout the world, but it varies according to the conditions under which people become bilingual, the uses they have for their various languages, and the societal status of these languages (August & Hakuta, 1997). Research relating bilingualism to cognitive and creative functioning has often been weakened by poor design and poor control of extraneous variables. In most studies, bilingualism was assessed based on arbitrary criteria, and even in the studies in which precautions were taken to control for bilinguals' selection, only language skills were considered as selection criteria for inclusion in the bilingual group. Besides, most studies compared bilinguals with monolinguals and no specific attention was devoted to how the variations in the type of bilingualism may contribute to the cognitive and creative abilities. In this research project, an attempt was made to control for some of these potentially confounding variables and to specify a number of contributing factors. Bilingualism was defined in terms of individuals' cross-linguistic and cross-cultural experiences. These two factors were found to distinguish between different bilingual types in terms of their divergent thinking behavior. However, several additional methodological problems were identified that need to be considered in future research.

Defining bilingualism: Who are bilinguals?

Bilinguals are rarely equally fluent in both their languages. The characteristics of bilinguals are influenced by the complementarity principle: Bilinguals usually acquire and use their languages for different purposes, in different domains in life, and with different people (Grosjean, 1998). There was a long lasting discussion in the literature about limiting one's study to so-called true bilinguals – those equally skilled in two

languages (cf. Peal & Lambert, 1962). However, there are indications that such individuals are extremely rare. By this strict definition, out of 238 participants in this study who indicated that they spoke both English and Russian, only 7 could be considered as "perfectly balanced" or "true" bilingual. Thus, while it might be conceivable to limit one's experimental sample to perfectly balanced bilinguals, this would greatly sacrifice the generalization to the bilingual population at large. Therefore, it is prudent to consider bilingualism in a broader sense including individuals who are fluent in two languages, individuals who actively use, or attempt to use more than one language, even if they have not achieved fluency in L2 (Kroll & de Groot, 1997).

Participants' selection problems

Participants in this study were grouped as monolingual or bilingual. Although the participants' linguistic skills were carefully controlled for, two potential problems with assigning participants to one or another group should be emphasized. The first problem is the selection of monolingual participants. As Hakuta and Diaz (1985) pointed out, "in the real world, there is no such thing as random assignment to a bilingual and monolingual group" (p. 329) and it is almost impossible to control all variables that may have impact on this distinction. Indeed, there are virtually no individuals in the New York City area who were never exposed to other languages because of the highly mixed linguistic environment.

The second problem relates to the fact that the majority of bilingual participants in the US sample, who immigrated from the former Soviet Union, were exposed to the languages other than Russian, although none of them indicated that they were fluent in these languages. In addition, some of the bilingual participants from the Russian sample

indicated that they took foreign language classes other than English. As a result, among bilinguals selected for this study, there were individuals who spoke more than two languages, which might have raised the issue of multilingualism not accounted for in this project.

Language proficiency assessment problems

One of the striking problems in assessing bilingualism is testing the four major language skills (speaking, writing, listening, and reading) in both languages (cf. Padilla & Ruiz, 1973). Previous studies proposed various indirect measures of linguistic skills, such as rating scales and tests of linguistic fluency (Macnamara, 1967, 1969). Three measures for each language were used in this study: Picture Naming test (PNT), self-rating scales, and bilingual balance scale (BBS). The findings of significant correlations among all three measures lend support to the notion that self-ratings adequately reflect language abilities (Albert & Obler, 1978; Macnamara, 1967, 1969). The traditional self-rating scales of four major language skills (speaking, writing, listening, and reading) complimented by the self-rating of the strength of accent in both languages provided a good prediction of participants' PNT scores. In addition, participants were found to give a good estimation of their linguistic abilities by indicating their degree of bilingual balance on the 11-point BBS. These findings have at least one practical application for the assessment of bilingualism. They suggest that the degree of language proficiency can be measured with a limited number of tests rather than by a direct assessment of the 16 skills in both languages as suggested by Padilla (1977).

Another problem in bilingualism assessment is distinguishing between different bilingual groups based on their linguistic skills' assessment in a meaningful and

psychologically valid way. Most of the studies in the field use the statistical breaking points applied to continuous language proficiency measures (e.g., the upper and lower groups were labeled as "high" and "low" bilinguals based on their Spanish PNT score in Lemmon & Goggin, 1989; individuals whose composite Boston naming score felt within one standard deviation were labeled as "balanced" in Kohnert, Hernandez, & Bates, 1998). However, none of these studies introduced a measure that was sensitive to both proficiency in two languages and their linguistic balance. This study considered the PNT composite score that was thought to incorporate both these factors. However, it had an apparent disadvantage of being unable to distinguish between individuals whose linguistic balance compensated for linguistic fluency. Therefore, the distinction between the language proficiency groups was based on the arbitrarily selected cutoff PNT scores. With this strategy there is a chance that a number of participants who fall on the different sides of the cutoff points actually had the same levels of language proficiency when it comes to its influence on the divergent thinking abilities. Therefore, the sensitivity to the inherent differences between bilingual individuals could be lost. This might explain the lack of significant differences between the High and Unbalanced Proficiency bilinguals on most of the ATTA measures. The participants less proficient in one language could be included into the High Proficiency group and vice versa, the participants highly proficient in both languages could be included in the Unbalanced Proficiency group. Therefore, the problem of grouping criteria remains open for the future research.

Cross-cultural experience assessment problems

Although there is agreement in the literature on the importance of including cultural experience as a predictor for cognitive flexibility and creative abilities, there is

no clear methodology on how to measure this component. It is a well known problem in the psychological research on biculturalism: the cross-cultural experience is not only extremely difficult to define, but even more difficult to measure and relate to the individuals' cognitive functioning (Francis, 2000).

This study used a cultural exposure coefficient (CEC) to indirectly assess individuals' cross-cultural experience that was hypothesized to influence their conceptual system. Although the CEC has some redeeming features, it seems to be a tad simplistic in that mere exposure to a culture does not necessarily reflect the psychological ramifications of that exposure. For example, as Tropp, Erkut, Coll, Alarcon, and Garcia (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 prudent to employ a measure that assesses the psychological affiliation with both cultures.

This study attempted to employ a Psychological Acculturation Scale (PAS, Tropp et al., 1999) that was originally designed to assess cultural adaptation that distinguishes between the differential impact of time spent within a culture and individuals' psychological responses to that cultural exposure. The PAS consisted of ten 9-point Likert-type scales concerning individuals' psychological responses to a variety of cultural contexts (see Appendix G). The idea to use this scale came when the US sample had been already tested. To obtain the PAS scores from this sample, a web page was developed

where the PAS has been published as an electronic survey. The US participants were contacted by email with a request to fill out this survey. Only 36 out of 108 bilingual participants in the US sample responded to the survey. Therefore, the scale was rejected as a measure of the cross-cultural experience. However, a correlational analysis performed with this limited data showed a strong correlation between the PAS and the CEC (r=.44, p<.001), which replicated the results of the Tropp et al.'s study. They found that the PAS served as a stronger and more consistent correlate of participants' cultural behaviors and preferences than did their percentage of lifetime spent in the US (an index similar to the CEC in this study). Therefore, it might be methodologically plausible to use both the CEC and the PAS to assess individuals' cross-cultural experience in the future research on the cognitive effects of biculturalism.

Finally, another potential problem with biculturalism assessment could be the nature of the two cultures that were in focus of this study. It is entirely possible that certain aspects of the US and Russian cultures are too similar to initiate conceptual changes. Both these cultures have grown in traditions of Western civilization. Therefore, there might be too few principled distinctions that would allow culturally balanced individuals to develop two alternative perspectives on the same phenomena. Hence, it might be reasonable to consider more distant cultures that developed in completely different traditions (e.g., Western and Eastern cultures).

Conclusion

Several research questions were explored in this study. First, it was found that both individuals' cross-linguistic and cross-cultural experiences may contribute to their divergent thinking. This finding lends support to the appealing argument in the literature

that bilingualism should be studied not only in the context of individuals' linguistic abilities, but also in a sociocultural context. Moreover, disregarding the joint operation of these factors puts the bilingualism research outside the mainstream of cognitive psychology.

Second, it was shown that superior linguistic skills facilitate divergent thinking abilities, whereas balanced cross-cultural experience had a negative influence on divergent thinking. The last finding, however, could be explained by the effect of participants' subcultural experience. Further, it was also found that only a small portion of divergent thinking performance could be explained by the cross-linguistic and cross-cultural experiences in bilingual development. This implies that other factors in individuals' development might contribute to their creative abilities.

To account for this finding and for the fact that being bilingual does not necessary imply being creative, the results suggest that the positive effect of bilingualism on divergent thinking and creative abilities is likely limited to basic cognitive processing, which lays the foundation for more sophisticated processing during which the truly creative ideas may be extracted. The effectiveness of these cognitive processes might be influenced by various developmental factors different from bilingualism (e.g., intelligence, education, motivation, and personal experience).

Finally, a spreading activation process was 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 was speculated to facilitate the functioning of such a spreading activation mechanism. This speculation intended to explain bilinguals' superiority over monolinguals on the divergent thinking tasks

requiring simultaneous activation and elaboration of multiple distant concepts, but not extraction of unique and original solutions.

All together, the findings of this study lend 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 side, they tend to show greater divergent thinking abilities. Thus, the various uses of mundane cognitive functioning may result in superior divergent thinking. This notion has at least two practical applications. First, the view that eminent people are using the same cognitive mechanisms as everyone else allows researchers to use the methods of cognitive science and experimental cognitive psychology to study "normative creativity" (see Ward, Smith, & Vaid, 1997) in laboratory conditions in the same way as they study other human cognition.

Second, the idea that eminent creative performance can be achieved through elaboration of the same cognitive functions and structures as ones used in everyday activity suggests the importance of encouraging creative factor in education. The emphasis of today's educational system is rather on the manipulating of existent knowledge that results in finding a single correct solution. The idea that there is always a right solution that needs to be found often discourages schoolchildren from inventing new solutions that fall beyond the conventional ones. In other words, students are encouraged to memorize the answers provided by others instead of finding their own. In this framework, only the gifted or specially talented who have extraordinary creative abilities should worry about finding the new original solutions. The creative cognition approach

lays the foundation for the argument against the conventional education and stresses the importance of encouraging all students to be creative (Schank & Clearly, 1995).

Implications for future research

The conclusions of this study suggest several directions for the further research to pursue the question of how bilingualism and/or biculturalism influence cognitive flexibility and divergent and creative thinking.

A first direction is to explore further the methodologies assessing the cognitive implications of biculturalism. The measure of the cross-cultural experience used in this study was suspected of being insensitive to the structural changes that occur in bilingual memory as a result of this experience. Therefore, there is a need to find a reliable measure of cognitive processes that on one hand are influenced by cross-cultural experience and on the other account for variations in individuals' cognitive capacities. This measure should reflect the degree of individual's adaptation to one or another culture, i.e. to assess culture-specific habits of thought, which reveal the cultural wisdom and norms, pass judgments and analyze situations. The Psychological Acculturation Scale seems to be a particularly useful candidate for this assessment. Tropp and her colleagues (1999) reported that psychological acculturation (assessed by the PAS) and percentage of lifetime in the US (a procedure similar to the cultural exposure coefficient used in this study) served as predictors of the adapted cultural behavior and preferences in adolescent and adult bicultural individuals. The Proverbs test might be the other candidate. Anthropologists have often studied proverbs in different cultures and contexts as public representations of cultural wisdom (see Dundes, 1989), and recently some researchers started to use proverbs in cross-cultural studies (e.g., Peng & Nisbett, 1999; Zislin &

Kotik-Friedgut, 2002). The degree of understanding of proverbs might provide deeper insight into individuals' cultural adaptation than their mere exposure to both cultures.

A second direction to examine is the influence of cross-cultural experience on cognition in general and on divergent and creative thinking in particular. In a cross-regional study, careful control should be taken to account for bilingual and bicultural variables. Moreover, the cultures to be investigated should be more diverse to reveal the effect of the cross-cultural experience, if any. The ideal study investigating the cognitive effects of bilingualism and/or biculturalism should consider at least four groups: (1) a bilingual/bicultural group that includes individuals who lived in one country and immigrated to another where they acquired L2; (2) a bilingual/monocultural group that includes individuals who lived only in one bilingual country; (3) a monolingual/bicultural group that includes individuals who lived in a monolingual country, never acquired L2 and immigrated to another country with the same official language; and (4) a monolingual/monocultural group that includes individuals who lived in a monolingual country and never lived in any other one. This design is possible only with the individuals who lived in two different countries that share the same language. Yet, as suggested above, they need to be sufficiently diverse culturally to reveal any significant effects of the cross-cultural experience. Belgium (with Dutch and French as two official languages) and French Guiana (with French as official language) are suggested as a possible combination of two countries that share the same official language (French) and yet sufficiently differ in the cultural standards and norms (one is European country, whereas the other one is South American).

A third direction would be to elaborate on the model of bilingual memory proposed in this study. The model intended to account for the effects of cross-linguistic experience on divergent thinking only. However, it would be interesting to try to expand this model to account for the effects of other factors in bilingual (e.g., age of L2 acquisition), bicultural (e.g., cross-cultural experience) and overall (e.g., intelligence, education, motivation, etc.) development on divergent and creative thinking. A related question concerns the broader context of creativity research. What are the cognitive processes and mechanisms (beyond the spreading activation mechanism proposed in this study) that underlie creative thought? To understand this, one should study the factors in individuals' development that might influence their creative thought in different social and cultural settings and in artistic and non-artistic populations.

A fourth direction would be to study the effect of multilingualism on cognitive and creative abilities. The importance of studying multilingualism is generally recognized (Ardila, 1998) as it becomes prevalent throughout the world since people can move across the globe more easily than ever before. The fact that many people speak more than two languages raises the question whether multilingualism has an effect on cognitive functioning different from the effect of bilingualism. It was found that the virtue of speaking two languages might have an impact on divergent thinking. Does this influence intensify in individuals who speak more than two languages? At this point, we simply do not know.

Finally, the important questions are whether bilingualism and/or biculturalism influence cognitive development in children and whether the cross-linguistic and cross-cultural factors in bilingual education are beneficial for cognitive growth. 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 particular and measurable impact on cognitive functioning? In this direction, the methodologies of the bilingual education should be studied with the potential look into the development of the creativity oriented educational programs.

Appendix A: Background questionnaire (bilingual version).

Name		**Subject number**	
Phone	( )	**E-mail**	
Age		**Birth date** (MM/DD/YYYY) / /19	**Gender**
Birthplace (City, State, Country)			
How old were you when you came to the US?		**How many years do you live in the US?**	

Education

If you didn't attend a secondary school or an University put N/A

Russia

Secondary school / Средняя школа _____ *(put **N/A** if you didn't attend it)*

How many years? _____

What other language(s) did you learn there? *(check appropriate)*

- ☐ English
- ☐ German
- ☐ French
- ☐ Spanish
- ☐ Other (specify) _____

Was it a special language school? / Языковая спец. школа *(circle one)* Yes | No

University / Институт _____ *(put **N/A** if you didn't attend it)*

What was the name of the University? _____

How many years? _____

What other language(s) did you learn there? *(check appropriate)*

- ☐ English
- ☐ German
- ☐ French
- ☐ Spanish
- ☐ Other (specify) _____

Did you take an advanced language class? *(circle one)* Yes | No

USA

If you didn't attend a high school or college put N/A

High school _____ *(put **N/A** if you didn't attend it)*

What was the name of the school? _____

How many years? _____

What other language(s) did you learn there? *(check appropriate)*

- ☐ English
- ☐ German
- ☐ French
- ☐ Spanish
- ☐ Other (specify) _____

What language(s) did you speak at school (outside the classroom, with your classmates)? *(circle one)*

Russian English both

College _____ *(put **N/A** if you didn't attend it)*

What is (was) the name of the college? _____

How many years? _____

What other language(s) did you learn there? *(check appropriate)*

- ☐ English
- ☐ German
- ☐ French
- ☐ Spanish
- ☐ Other (specify) _____

What language(s) do you speak at the college (outside the classroom, with your classmates)? *(circle one)*

Russian English both

Language proficiency

How old were you when you began to learn Russian? _____

In what country did you begin to learn Russian? _____

Where did you learn Russian? *(circle one)* Home | School | both

How old were you when you began to learn English? _____

In what country did you begin to learn English? _____

Where did you learn English? *(circle one)* Home | School | both

At what age did your usage of English begin to exceed the usage of Russian (i.e., age at which you started to use English more than 50% of the time) ? _____

Are you right- or left-handed? *(circle one)* Right | Left | Both

If you are right-handed, were forced to use right hand? *(circle one)* Yes | No

Standard Score

Did you take the TOEFL? *(circle one)* Yes | No

if YES, what was your score _____ (computer / paper based)

Did you take the SAT? *(circle one)* Yes | No

if YES, what was your verbal English score _____

Self-Rating

In the questions 1 through 10, circle the word or phrase that applies to you.

English

1. How well do you **understand** spoken English?
   not at all fair well very well

2. How well do you **speak** English?
   not at all fair well very well

3. How well do you **read** in English?
   not at all fair well very well

4. How well do you **write** in English?
   not at all fair well very well

5. Do you think you speak English with an **accent**?
   strong moderate no accent at all (like American)

Russian

6. How well do you **understand** spoken Russian?
   not at all fair well very well

7. How well do you **speak** Russian?
   not at all fair well very well

8. How well do you **read** in Russian?
   not at all fair well very well

9. How well do you **write** in Russian?
   not at all fair well very well

10. Do you think you speak Russian with an **accent**?
    strong moderate no accent at all

Check the box that reflects your degree of Russian-English bilingualism. Ignore any other language you may speak.

I speak only Russian					I am fully bilingual					I speak only English

What other language(s) do you speak?

Rate your language command from 0(not at all) to 3 (very well) for each language in the table below

Language	Rate

How would you estimate your ability to learn foreign languages? *(circle one)*

can't learn at all difficult fairly quickly very easy

Home and Friends

What language(s) do you speak at home? _____

What percent of each language do you use at home?

English _____ Russian _____ Other _____

What language(s) do you speak with your friends? _____

What percent of each language do you use with your friends?

English _____ Russian _____ Other _____

What is your yearly family household income? _____

Language Preference

In the questions 1 through 9, circle only one word or phrase that applies to you.

1. What language do you think in?
   Russian English both

2. What language do you dream in?
   Russian English both

3. In which language do you prefer to make mental arithmetic operations?
   For example, 37 – 19 = ?
   Russian English no preference

4. In which language do you prefer reading for pleasure?
   Russian English both

5. In which language do you watch TV?
   Russian English both

6. If you kept a diary, which language would you write it in?
   Russian English either one

7. In which language do you understand jokes better?
   Russian English either one

8. Do you prefer to hang out with Russian- or English-speaking friends?
   Russian English no preference

9. Which language do you prefer to speak with your friends?
   Russian English no preference

Appendix B: Background questionnaire (monolingual version).

Name		**Subject number**	
Phone	( )	**E-mail**	
Age		**Birth date** (MM/DD/YYYY) / /19	**Gender**
Birthplace (City, State, Country)			

Education

If you didn't attend a high school or college put N/A

High school _____ *(put **N/A** if you didn't attend it)*

What was the name of the school? _____

How many years? _____

What other language(s) did you learn there? *(check appropriate)*

- ☐ English
- ☐ German
- ☐ French
- ☐ Spanish
- ☐ Other (specify) _____

College _____ *(put **N/A** if you didn't attend it)*

What is (was) the name of the college? _____

How many years? _____

What other language(s) did you learn there? *(check appropriate)*

- ☐ English
- ☐ German
- ☐ French
- ☐ Spanish
- ☐ Other (specify) _____

What is your yearly family household income? _____

Are you right- or left-handed? *(circle one)* Right | Left | Both

If you are right-handed, were forced to use right hand? *(circle one)* Yes | No

Standard Score

Did you take the SAT? *(circle one)* Yes | No

if YES, what was your verbal English score _____

Self-Rating

In the questions 1 through 5, circle the word or phrase that applies to you.

English

11. How well do you **understand** spoken English?

not at all fair well very well

12. How well do you **speak** English?

not at all fair well very well

13. How well do you **read** in English?

not at all fair well very well

14. How well do you **write** in English?

not at all fair well very well

15. Do you think you speak English with an **accent**?

strong moderate no accent at all

What other language(s) do you speak?

_____

_____

_____

_____

*In the questions 6 through 10, for the language that you speak the best other than English, circle the word or phrase that applies to you in questions 6 through 10. If you speak only English, just put **n/a**.*

Language:_____

16. How well do you **understand** spoken language?

not at all fair well very well

17. How well do you **speak** this language?

not at all fair well very well

18. How well do you **read** in this language?

not at all fair well very well

19. How well do you **write** in this language?

not at all fair well very well

20. Do you think you speak this language with an **accent**?

strong moderate no accent at all

Did you live in another county? *(circle one)* Yes | No

If YES, what country and for how long? _____

How would you estimate your ability to learn foreign languages? *(circle one)*

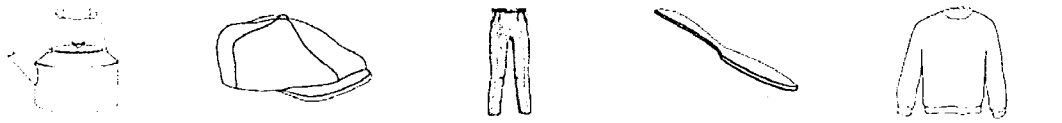
can't learn at all difficult fairly quickly very easy

Appendix C: Picture naming test (excerpt of one page of the test).

1	2	3	4	5

6	7	8	9	10

11	12	13	14	15



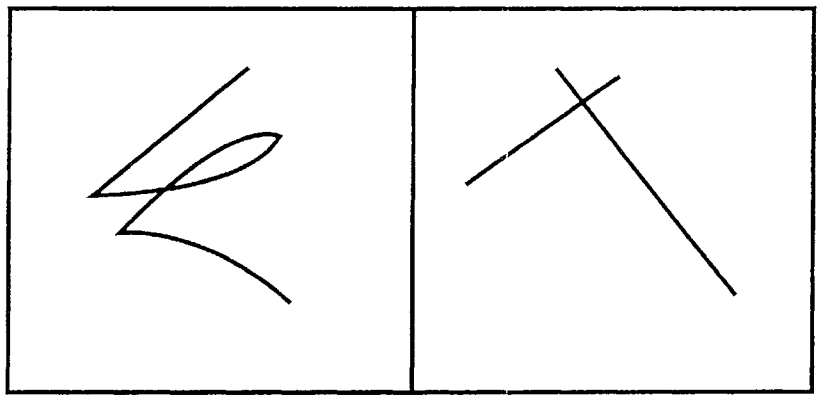
16	17	18	19	20

21	22	23	24	25

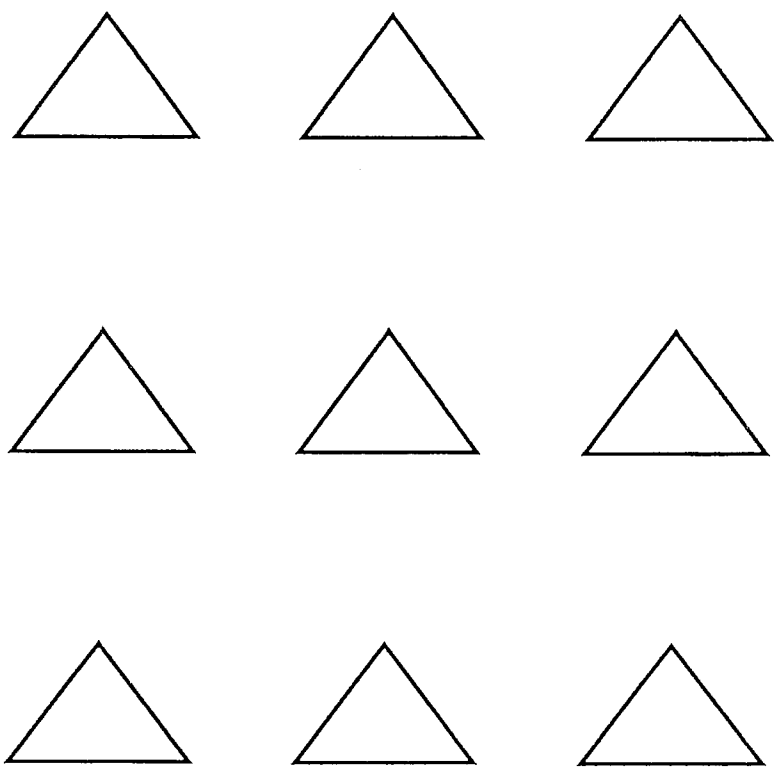
26	27	28	29	30

Appendix D: Abbreviated Torrance Test for Adults.

1) Activity 2.



2) Activity 3.



Appendix E: Abbreviated Torrance Test for Adults' scoring/interpretation worksheet.

Norm-Referenced Measures

Creative Ability	Raw Scores: Activity 1	Activity 2	Activity 3	Total Score
Fluency				
Originality				
Elaboration	X			
Flexibility	X	X		

Scaled Scores	11	12	13	14	15	16	17	18	19	Scaled Scores
Corresponding Raw Scores	1–6	7	8–9	10	11–12	13–14	15–16	17	18+	
	1	2	3	4	5	6	7–8	9–10	11+	
	1–3	4–5	6–8	9–11	12–14	15–18	19–23	24–27	28+	
	–	1	–	2	3	–	4	5	6+	
Creative Roles:	Collaborator			Contributor			Accelerator			

Total Scaled Score ____

Criterion-Referenced Creativity Indicators

Verbal Responses (Activity #1)

Tally	Rating	Raw Score	
____	____	____	1. Richness and Colorfulness of Imagery
____	____	____	2. Emotions/Feelings
____	____	____	3. Future Orientation
____	____	____	4. Humor: Conceptual Incongruity
____	____	____	5. Provocative Questions
	Total	____	

Figural Responses (Activities #2 and #3)

Tally	Rating	Raw Score	
____	____	____	6. Openness: Resistance to Premature Closure
____	____	____	7. Unusual Visualization, Different Perspective
____	____	____	8. Movement and/or Sound
____	____	____	9. Richness and/or Colorfulness of Imagery
____	____	____	10. Abstractness of Titles
____	____	____	11. Articulateness in Telling Story
____	____	____	12. Combination/Synthesis of Two or More Figures
____	____	____	13. Internal Visual Perspective
____	____	____	14. Expressions of Feelings and Emotions
____	____	____	15. Fantasy
	Total	____	

Composite Measures

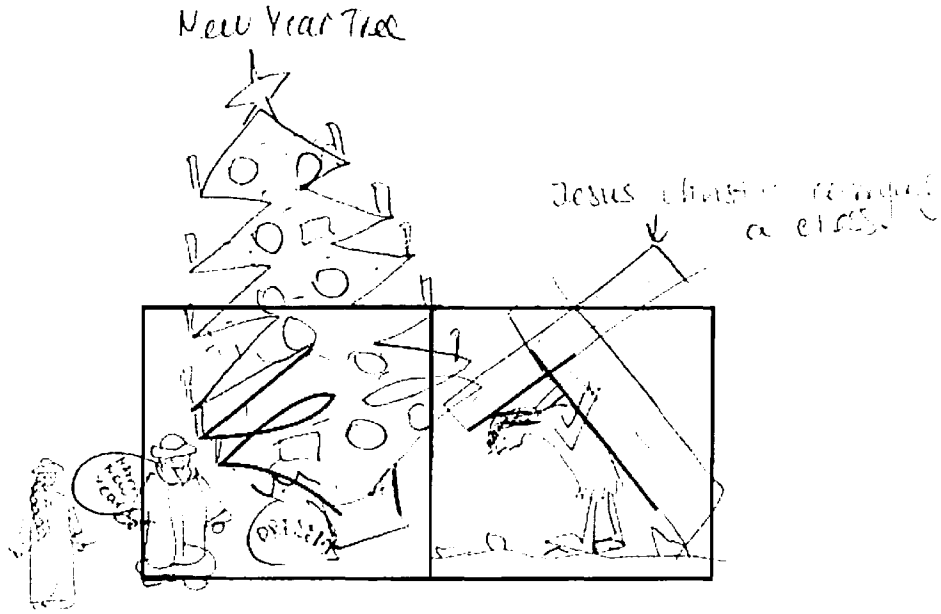
____ Total Scaled Score
\+ ____ Total Indicator Score (Count 1-point for each "+" and 2 for each "++")
= ____ CREATIVITY INDEX (CI)

*Creativity Index**	1–50	51–59	60–67	68–73	74–77	78–84	85+
Creativity Level	1	2	3	4	5	6	7
Verbal Assessment	Minimal	Low	Below Average	Average	Above Average	High	Substantial
% of Adults in Level	4%	12%	20%	26%	20%	12%	4%

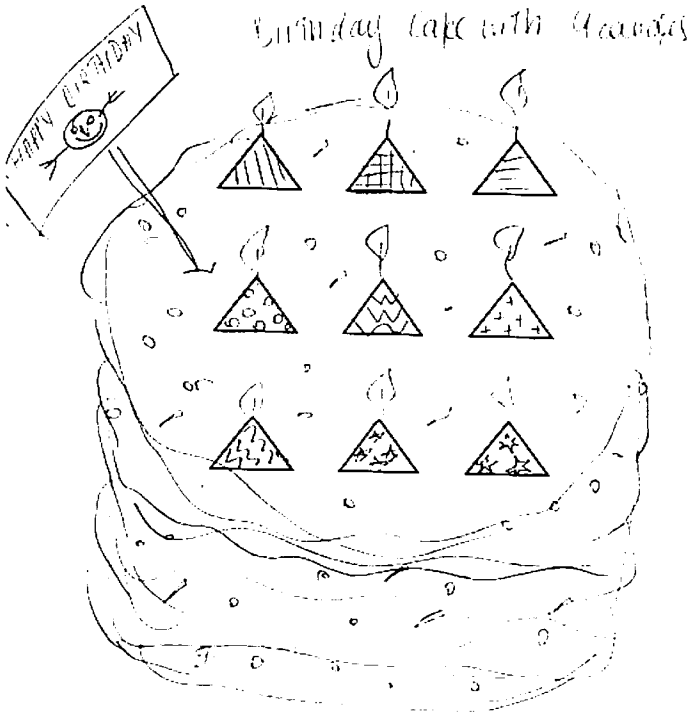
*Interpretive Aid–Find Creativity Index in top row score range. Use information in that column to help understand the CI.

Appendix F

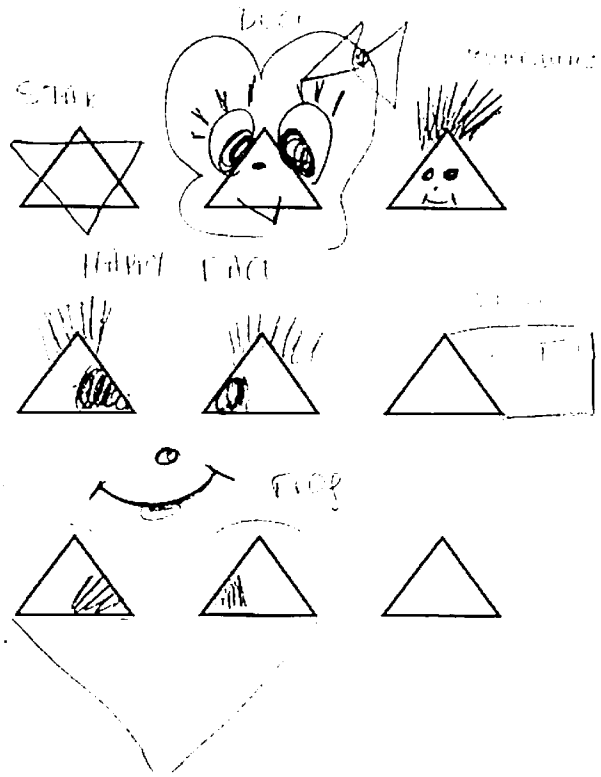
Activity 2 scored highest on the ATTA measures of originality and elaboration (Case 17).



Activity 3 scored highest on the ATTA measures of originality and elaboration (Case 17).



Activity 3 scored highest on the ATTA measure of flexibility (Case 24).



Appendix G: Psychological Acculturation Scale.

Check the box that reflects your cultural preferences for each question. The more to the right, the more American culturally oriented you are; the more to the left, the more Russian culturally oriented you are.

	only Russian				both				only American
1. With which group(s) of people do you feel you share most of your beliefs and values?									
2. With which group(s) of people do you feel you have the most in common?									
3. With which group(s) of people do you feel the most comfortable?									
4. In your opinion, which group(s) of people best understands your ideas (your way of thinking)?									
5. Which culture(s) do you feel proud to be a part of?									
6. In which culture(s) do you know how things are done and feel that you can do them easily?									
7. In which culture(s) do you feel confident that you know how to act?									
8. In your opinion, which group(s) of people do you understand best?									
9. In which culture(s) do you know what is expected of a person in various situations?									
10. Which culture(s) do you know the most about the history, traditions, and customs, and so forth?									

Do you feel a strong affinity with any other culture(s)? *(circle one)* Yes | No

If YES, specify which: _____

_____

_____

REFERENCES

Albert, M. L., & Obler, L. K. (1978). *The bilingual brain.* New York: Academic.

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

Amabile, T. M. (1996). *Creativity in context: Update to "The Social Psychology of Creativity."* Boulder, CO: Westview Press.

Appel, R. (2000). Language, concepts and culture: Old wine in new bottles? *Bilingualism: Language & Cognition, 3*, 5-6.

Ardila, A. (1998). Bilingualism: A neglected and chaotic area. *Aphasiology, 12*, 131-134.

August, D., & Hakuta, K. (1997). *Improving Schooling for Language-Minority Children: A Research Agenda.* Washington, DC: National Academy Press.

Baer, J. (1993). *Divergent thinking and creativity: A task-specific approach.* Hillsdale, NJ: Erlbaum.

Baer, J. (1994). Why you still shouldn't trust creativity tests. *Educational Leadership, 52*, 72-73.

Barron, F., & Harrington, D. M. (1981). Creativity, intelligence, and personality. *Annual Review of Psychology, 32*, 439-476.

Barron, F., & Welsh, G. S. (1952). Artistic perception as a possible factor in personality style: its measurement by a figure preference test. *Journal of Psychology, 33*, 199-203.

Bartlett, M. M., & Davis, G. A. (1974). Do the Wallach and Kogan tests predict real creative behavior? *Perceptual & Motor Skills, 39*, 730.

Basadur, M., & Hausdorf, P. A. (1996). Measuring divergent thinking attitudes related to creative problem solving and innovation management. *Creativity Research Journal, 9*, 21-32.

Ben-Zeev, S. (1977). The influence of bilingualism on cognitive strategy and cognitive development. *Child Development, 48*, 1009-1018.

Berger, R. M., & Guilford, J. P. (1969). *Pilot Titles.* Beverly Hills, CA: Sheridan Psychological Services.

Bialystok, E. (1988). Levels of bilingualism and levels of linguistic awareness. *Developmental Psychology, 24*, 560-567.

Birman, D., & Trickett, E. J. (2001). Cultural transitions in first-generation immigrants: Acculturation of Soviet Jewish refugee adolescents and parents. *Journal of Cross-Cultural Psychology, 32*, 456-477.

Birman, D., Trickett, E. J., & Vinokurov, A. (2002). Acculturation and adaptation of Soviet Jewish refugee adolescents: Predictors of adjustment across life domains. *American Journal of Community Psychology, 30*, 585-607.

Bronfenbrenner, U. (1970). *Two worlds of childhood: U.S. and U.S.S.R.* New York: Russell Sage Foundation.

Brown, R. T. (1989). Creativity: What are we to measure? In J. A. Glover & R. R. Ronning (Eds.), *Handbook of creativity.* (pp. 3-32). New York: Plenum Press.

Carringer, D. C. (1974). Creative thinking abilities of Mexican youth: The relationship of bilingualism. *Journal of Cross-Cultural Psychology, 5*, 492-504.

Carrol, J. B., & Maxwell, S. E. (1979). Individual differences in cognitive abilities. *Annual Review of Psychology, 30*, 603-640.

Chomsky, N. (1972). *Language and mind.* New York: Harcourt, Brace, Jovanovich.

Chorney , M. (1978). *The relationship of bilingualism and creativity.* Unpublished honors thesis, University of Adulate.

Christensen, P. R., Guilford, J. P., Merrifield, P. R., & Wilson, R. C. (1960). *Alternative Uses.* Beverly Hills, CA: Sheridan Psychological Services.

Christensen, P. R., Merrifield, P. R., & Guilford, J. P. (1953). *Consequences.* Beverly Hills, CA: Sheridan Psychological Services.

Cook, V. (1990). Timed comprehension of binding in advanced L2 learners of English. *Language Learning, 40*, 557-599.

Cook, V. (1997). The consequences of bilingualism for cognitive processing. In A. M. B. de Groot & J. F. Kroll (Eds.), *Tutorials in bilingualism: Psycholinguistic perspectives.* (pp. 279-299). Hillsdale, NJ: Erlbaum.

Cummins, J. (1976). The influence of bilingualism on cognitive growth: A synthesis of research findings and explanatory hypothesis. *Working Papers on Bilingualism, 9*, 1-43.

Cummins, J. (1978). Bilingualism and the development of metalinguistic awareness. *Journal of Cross-Cultural Psychology, 9*, 131-149.

Cummins, J. (1979). Linguistic interdependence and the educational development of bilingual children. *Review of Educational Research, 49*, 222-251.

Cummins, J., & Gulutsan, M. (1974). Some effects of bilingualism on cognitive functioning. In S. T. Carey (Ed.), *Bilingualism, biculturalism and education.* Edmonton: University of Alberta.

Davis, G., & Belcher, T. L. (1971). How shall creativity be measured? Torrance tests, RAT, Alpha Biographical and IQ. *Journal of Creative Behavior, 5*, 153-161.

Davis, G. A. (1989). Testing for creative potential. *Contemporary Educational Psychology, 14*, 257-274.

de Groot, A. M. B. (2000). On the source and nature of semantic and conceptual knowledge. *Bilingualism: Language & Cognition, 3*, 7-9.

de Groot, A. M. B., & Kroll, J. F. (1997). *Tutorials in bilingualism: Psycholinguistic perspectives.* Hillsdale, NJ: Erlbaum.

Diaz, R. M. (1985). Bilingual cognitive development: Addressing three gaps in current research. *Child Development, 56*, 1376-1388.

Dijkstra, T., & van Heuven, W. J. B. (1998). The BIA model and bilingual word recognition. In J. Grainger & A. M. Jacobs (Eds.), *Localist connectionist approaches to human cognition.* (pp. 189-225): Lawrence Erlbaum Associates, Publishers.

Dundes, A. (1989). *Folklore matters.* Knoxville: University of Tennessee Press.

Dunn, L. M. (1965). *Peabody Picture Vocabulary Test.* Circle Pines, MN: American Guidance Service.

Ellison, B. A. (1973). Creativity in black artists: A comparison of selected creativity measures using judged creativity as a criterion. *Journal of Non-White Concerns in Personnel & Guidance, 1*, 150-157.

Ervin-Tripp, S. (2000). Bilingual minds. *Bilingualism: Language & Cognition, 3*, 10-12.

Eysenck, H. J. (1995). *Genius: The natural history of creativity.* New York: Cambridge University Press.

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

Francis, W. S. (2000). Clarifying the cognitive experimental approach to bilingual research. *Bilingualism: Language & Cognition, 3*, 13-15.

Gardner, H. (1993). *Creating minds*. New York: Basic Books.

Gerard, L. D., & Scarborough, D. L. (1989). Language-specific lexical access of homographs by bilinguals. *Journal of Experimental Psychology: Learning, Memory, & Cognition, 15*, 305-315.

Getzels, J. W., & Csikszentmihalyi, M. (1964). *Creative thinking in art students: An exploratory study.* (No. Cooperative Research Project No. E-008): Office of Education, U.S. Department of Health, Education and Welfare, University of Chicago.

Getzels, J. W., & Csikszentmihalyi, M. (1976). *The creative vision: A longitudinal study of problem finding in art.* New York: Wiley.

Getzels, J. W., & Jackson, P. W. (1962). *Creativity and intelligence: Explorations with gifted students.* New York: Wiley.

Goff, K., & Torrance, E. P. (2002). *Abbreviated Torrance Test for Adults*. Bensenville, IL: Scholastic Testing Service.

Gordon, M. M. (1964). *Assimilation in American life: The role of race, religion, and national origins.* New York: Oxford University Press.

Gowan, J. C., & Torrance, E. P. (1965). An intercultural study of non-verbal ideational fluency. *The Gifted Child Quarterly, 9.*

Grainger, J., & Dijkstra, T. (1992). On the representation and use of language information in bilinguals. In R. J. Harris (Ed.), *Cognitive processing in bilinguals.* (pp. 207-220). Oxford, England: North-Holland.

Grosjean, F. (1998). Studying bilinguals: Methodological and conceptual issues. *Bilingualism: Language & Cognition, 1*, 131-149.

Guilford, J. P. (1950). Creativity. *American Psychologist, 5*, 444-454.

Guilford, J. P. (1967). *The nature of human intelligence.* New York: McGraw-Hill.

Guilford, J. P., & Christensen, P. R. (1973). The one-way relation between creative potential and IQ. *Journal of Creative Behavior, 7*, 247-252.

Hakuta, K. (1984). *The causal relationship between the development of bilingualism, cognitive flexibility, and social-cognitive skills in Hispanic elementary school children [Final report].* (No. ERIC Document Reproduction Service No. ED 264 3 14). New Haven, CT: Yale University, Department of Psychology.

Hakuta, K., & Diaz, R. M. (1985). The relationship between degree of bilingualism and cognitive ability: A critical discussion and some new longitudinal data. In K. E. Nelson (Ed.), *Children's language, Vol. 5.* (pp. 319-344). Hillsdale, NJ: Erlbaum.

Harris, J. G., Cullum, C. M., & Puente, A. E. (1995). Effects of bilingualism on verbal learning and memory in Hispanic adults. *Journal of the International Neuropsychological Society, 1*, 10-16.

Hattie, J. (1980). Should creativity tests be administered under test-like conditions? An empirical study of three alternative conditions. *Journal of Educational Psychology, 72*, 87-98.

Hocevar, D. (1980). Intelligence, divergent thinking, and creativity. *Intelligence, 4*, 25-40.

Hocevar, D. (1981). Measurement of creativity: Review and critique. *Journal of Personality Assessment, 45*, 450-464.

Holtzman, W. H. (1980). *Divergent thinking as a function of the degree of bilingualism of Mexican-American and Anglo fourth-grade students*. University Microfilms International.

Horng, R.-Y. (1981). *Imagery abilities, sex, and intelligence as predictors of creative thinking.* University Microfilms International.

Horowitz, R. T., & Kraus, V. (1984). Patterns of cultural transition: Soviet and American children in a new environment. *Journal of Cross-Cultural Psychology, 15*, 399-416.

Ianco-Worrall, A. D. (1972). Bilingualism and cognitive development. *Child Development, Vol. 43*, 1390-1400.

Kessler, C., & Quinn, M. (1987). Language minority children's linguistic and cognitive creativity. *Journal of Multilingual and Multicultural Development, 8*, 73-186.

Khandwalla, P. N. (1993). An exploratory investigation of divergent thinking through protocol analysis. *Creativity Research Journal, 6*, 241-259.

Kim, J., & Michael, W. B. (1995). The relationship of creativity measures to school achievement and to preferred learning and thinking style in a sample of Korean high school students. *Educational & Psychological Measurement, 55*, 60-74.

Koestler, A. (1968). *The ghost in the machine.* Lewiston, NY: Macmillan.

Kohnert, K. J., Hernandez, A. E., & Bates, E. (1998). Bilingual performance on the Boston Naming Test: Preliminary norms in Spanish and English. *Brain & Language, 65*, 422-440.

Konaka, K. (1997). *The relationship between degree of bilingualism and gender to divergent thinking ability among native Japanese-speaking children in the New York area.* University Microfilms International.

Kroll, J. F., & de Groot, A. M. B. (1997). Lexical and conceptual memory in the bilingual: Mapping form to meaning in two languages. In A. M. B. de Groot & J. F. Kroll (Eds.), *Tutorials in bilingualism: Psycholinguistic perspectives.* (pp. 169-199). Hillsdale, NJ: Erlbaum.

Lamb, S. (1999). *Pathways of the brain.* Amsterdam: John Benjamins.

Lambert, W. E. (1955). Measurement of the linguistic dominance of bilinguals. *Journal of Abnormal & Social Psychology, 50*, 197-200.

Lambert, W. E. (1975). Culture and language as factors in learning and education. In A. Wolfgang (Ed.), *Education of Immigrant Students* (pp. 55-83). Toronto, ON: Institute for Studies in Education.

Lambert, W. E. (1977). The effect of bilingualism on the individual: Cognitive and social consequences. In P. A. Hornby (Ed.), *Bilingualism: Psychological, social and educational implications*. New York: Academic.

Lehman, J. D., Kahle, J. B., & Nordland, F. (1981). Cognitive development and creativity: A study in two high schools. *Science Education, 65*, 197-206.

Lehtonen, J., & Sajavaara, K. (1988). Psycholinguistic testing of transfer in foreign-language speech processing. *Folia Linguistica, 22*, 179-202.

Lemmon, C. R., & Goggin, J. P. (1989). The measurement of bilingualism and its relationship to cognitive ability. *Applied Psycholinguistics, 10*, 133-155.

Lopez, E. C. (2003). Creativity issues concerning linguistically and culturally diverse children. In J. Houtz (Ed.), *Educational psychology of creativity.* (pp. 107-127). Cresskill, NJ: Hampton Press, Inc.

Lopez, M. (1977). Bilingual memory research: Implications for bilingual education. In J. L. Martinez, Jr. (Ed.), *Chicano psychology* (pp. 111-126). New York: Academic.

Lubart, T. I. (1994). Creativity. In R. J. Sternberg (Ed.), *Thinking and problem solving.* (pp. 289-332). San Diego, CA: Academic Press, Inc.

Lubart, T. I. (1999). Creativity across cultures. In R. J. Sternberg (Ed.), *Handbook of creativity.* (pp. 339-350). New York: Cambridge University Press.

Lubart, T. I. (2000). Models of the Creative Process: Past, Present and Future. *Creativity Research Journal, 13*, 295-308.

Lubart, T. I., & Getz, I. (1997). Emotion, metaphor and the creative process. *Creativity Research Journal, 10*, 285-301.

MacNab, G. L. (1979). Cognition and bilingualism: A reanalysis of studies. *Linguistics, 17*, 231-255.

Macnamara, J. T. (1967). The bilinguals' linguistic performance. A psychological overview. *Journal of Social Issues, 23*, 58-77.

Macnamara, J. T. (1969). How can one measure the extent of a person's bilingual proficiency? In L. G. Kelly (Ed.), *Description and measurement of bilingualism: An international seminar. University of Moncton, June 6-14, 1967* (pp. 80-97). Toronto: University of Toronto Press.

Maegiste, E. (1992). Leaning to the right: Hemispheric involvement in bilinguals. In R. J. Harris (Ed.), *Cognitive processing in bilinguals.* (pp. 549-560). Oxford, England: North-Holland.

Magnusson, D., & Backteman, G. (1978). Longitudinal stability of person characteristics: Intelligence and creativity. *Applied Psychological Measurement, 2*, 481-490.

Marin, G., Sabogal, F., Marin, B. V., & Otero-Sabogal, R. (1987). Development of a short acculturation scale for Hispanics. *Hispanic Journal of Behavioral Sciences, 9*, 183-205.

Markman, A. B., & Gentner, D. (1993). Splitting the differences: A structural alignment view of similarity. *Journal of Memory & Language, 32*, 517-535.

Martindale, C. (1989). Personality, situation, and creativity. In J. A. Glover & R. R. Ronning (Eds.), *Handbook of creativity* (pp. 211-232). New York: Plenum Press.

Mayer, R. (1999). Problem solving. In M. A. Runco & S. R. Pritzker (Eds.), *Encyclopedia of creativity* (Vol. 2, pp. 437-447). San Diego, CA: Academic Press.

Mednick, S. A. (1962). The associative basis of the creative process. *Psychological Review, 69*, 220-232.

Mednick, S. A., & Mednick, M. T. (1967). *Examiner's manual: Remote Associates Test.* Boston: Houghton Mifflin.

Merrifield, P. R., Guilford, J. P., Christensen, P. R., & Frick, J. W. (1962). The role of intelligence factors in problem solving. *Psychological Monographs, 76*, 1-21.

Metcalfe, A. R. J. (1978). Divergent thinking "threshold effect": IQ, age, or skill? *Journal of Experimental Education, 47*, 4-8.

Mumford, M. D. (2000). Something old, something new: Revising Guilford's conception of creative problem solving. *Creativity Research Journal, 13*, 267-276.

Mumford, M. D., Marks, M. A., Connelly, M. S., Zaccaro, S. J., & Johnson, J. F. (1998). Domain-based scoring of divergent-thinking tests: Validation evidence in an occupational sample. *Creativity Research Journal, 11*, 151-163.

Mumford, M. D., Mobley, M. I., Uhlman, C. E., Reiter-Palmon, R., & Doares, L. M. (1991). Process analytic models of creative capacities. *Creativity Research Journal, 4*, 91-122.

Mumford, M. D., Peterson, N. G., & Childs, R. A. (1999). Basic and cross-functional skills. In N. G. Peterson & M. D. Mumford (Eds.), *An occupational information system for the 21st century: The development of O*NET* (pp. 49-69). Washington, D.C.: American Psychological Association.

Niaz, M., & Saud de Nunez, G. (1991). The relationship of mobility/fixity to creativity formal reasoning and intelligence. *Journal of Creative Behavior, 25*, 205-217.

Ochse, R. (1990). *Before the gates of excellence: the determinants of creative genius.* New York: Cambridge University Press.

Okoh, N. (1980). Bilingualism and divergent thinking among Nigerian and Welsh school children. *Journal of Social Psychology, 110*, 163-170.

Padilla, A. M. (1977). Child bilingualism: Insights to issues. In J. Martinez J. L. (Ed.), *Chicano psychology.* (pp. 111-126). New York: Academic Press.

Padilla, A. M., & Ruiz, R. A. (1973). *Latino mental health: A review of literature.* Oxford, England: U.S. Government Printing Office, Dh.

Palmer, M. B. (1972). Effects of categorization, degree of bilingualism and language upon recall of select monolinguals and bilinguals. *Journal of Educational Psychology, Vol. 63*, 160-164.

Paradis, M. (1986). Foreword. In J. Vaid (Ed.), *Language processing in bilinguals: Psycholinguistic and neuropsychological perspectives.* (pp. xi-xii). Hillsdale, NJ: Erlbaum.

Paradis, M. (1997). The cognitive neuropsychology of bilingualism. In A. M. B. de Groot & J. F. Kroll (Eds.), *Tutorials in bilingualism: Psycholinguistic perspectives* (pp. 331-354). Hillsdale, NJ: Erlbaum.

Paradis, M. (2000). Cerebral representation of bilingual concepts. *Bilingualism: Language & Cognition, 3*, 22-24.

Pavlenko, A. (1997). *Bilingualism and cognition.* University Microfilms International.

Pavlenko, A. (1999). New approaches to concepts in bilingual memory. *Bilingualism: Language & Cognition, 2*, 209-230.

Pavlenko, A. (2000). New approaches to concepts in bilingual memory. *Bilingualism: Language & Cognition, 3*, 1-4.

Peal, E., & Lambert, W. E. (1962). The relation of bilingualism to intelligence. *Psychological Monographs, 76*, 23.

Peng, K., & Nisbett, R. E. (1999). Culture, Dialectics, and Reasoning About Contradiction. *American Psychologist, 54*, 741-754.

Perani, D., Paulesu, E., Galles, N. S., Dupoux, E., Dehaene, S., Bettinardi, V., et al. (1998). The bilingual brain: Proficiency and age of acquisition of the second language. *Brain, 121*, 1841-1852.

Pinker, S. (1984). *Language learnability and language development.* Cambridge, MA: Harvard University Press.

Plucker, J. A. (1999). Is the proof in the pudding? Reanalyses of Torrance's (1958 to present) longitudinal data. *Creativity Research Journal, 12*, 103-114.

Plucker, J. A., & Renzulli, J. S. (1999). Psychometric approaches to the study of human creativity. In R. J. Sternberg (Ed.), *Handbook of creativity.* (pp. 35-61). New York: Cambridge University Press.

Price-Williams, D. R., & Ramirez, M. (1977). Divergent thinking, cultural differences, and bilingualism. *Journal of Social Psychology, 103*, 3-11.

Reynolds, A. G. (1991). *Bilingualism, multiculturalism, and second language learning: The McGill Conference in Honour of Wallace E. Lambert.* Hillsdale, NJ: Erlbaum.

Ricciardelli, L. A. (1992a). Bilingualism and cognitive development in relation to threshold theory. *Journal of Psycholinguistic Research, 21*, 301-316.

Ricciardelli, L. A. (1992b). Creativity and bilingualism. *Journal of Creative Behavior, 26*, 242-254.

Rosenblum, T., & Pinker, S. A. (1983). Word magic revisited: Monolingual and bilingual children's understanding of the word-object relationship. *Child Development, 54*, 773-780.

Rossion, B., & Pourtois, G. (2001). *Revisiting Snodgrass and Vanderwart's object database: Color and Texture improve Object Recognition.* Paper presented at the VisionScienceS Conference, Sarasota, FL.

Rothenberg, A. (1979). *The emerging goddess: The creative process in art, science and other fields.* Chicago, IL: University of Chicago Press.

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

Runco, M. A. (1986). Divergent thinking and creative performance in gifted and nongifted children. *Educational & Psychological Measurement, 46*, 375-384.

Runco, M. A. (1991). *Divergent thinking.* Westport, CT: Ablex Publishing.

Runco, M. A. (1993). Divergent thinking, creativity, and giftedness. *Gifted Child Quarterly, 37*, 16-22.

Runco, M. A., & Mraz, W. (1992). Scoring divergent thinking tests using total ideational output and a creativity index. *Educational & Psychological Measurement, 52*, 213-221.

Saeki, N., Fan, X., & Van Dusen, L. (2001). A comparative study of creative thinking of American and Japanese college students. *Journal of Creative Behavior, 35*, 24-36.

Schank, R. C., & Clearly, C. (1995). *The creative cognition approach.* Cambridge, MA: The MIT Press.

Schumann, J. (1978). *The Pidginization process: A model for second language acquisition*. Rowley, MA: Newbury House.

Simonton, D. K. (1994). *Greatness: Who makes history and why.* New York: Guilford Press.

Simonton, D. K. (1998). Donald Campbell's model of the creative process: Creativity as blind variation and selective retention. *Journal of Creative Behavior, 32*, 153-158.

Smith, M. C. (1997). How do bilinguals access lexical information? In A. M. B. de Groot & J. F. Kroll (Eds.), *Tutorials in bilingualism: Psycholinguistic perspectives* (pp. 145-168). Hillsdale, NJ: Lawrence Erlbaum Associates, Publishers.

Snodgrass, J. G., & Vanderwart, M. (1980). A standardized set of 260 pictures: Norms for name agreement, image agreement, familiarity, and visual complexity. *Journal of Experimental Psychology: Human Learning & Memory, 6*, 174-215.

Soares, C., & Grosjean, F. (1984). Bilinguals in a monolingual and a bilingual speech mode: The effect on lexical access. *Memory & Cognition* (Vol. 12, pp. 380-386). Psychonomic Society.

Srivastava, A. L., & Khatoon, R. (1980). Effect of difference between mother tongue and another tongue as medium of instruction on achievement, mental ability and creativity of the Vll standard children. In E. Annamalai. (Ed.), *Bilingualism and achievement in schools*. Mysore: CIIL.

Sternberg, R. J. (1999). *Handbook of creativity.* New York: Cambridge University Press.

Sternberg, R. J., & Grigorenko, E. L. (2000). Guilford's structure of intellect model and model of creativity: contributions and limitations. *Creativity Research Journal, 13*, 309-316.

Sternberg, R. J., & Lubart, T. I. (1995). *Defying the crowd: cultivating creativity in a culture of conformity*. New York: Free Press.

Sternberg, R. J., & O'Hara, L. A. (1999). Creativity and intelligence. In R. J. Sternberg (Ed.), *Handbook of creativity.* (pp. 251-272). New York: Cambridge University Press.

Stokes, P. (2000). Variations on Guilford's creative abilities. *Creativity Research Journal, 13*, 196-207.

Torrance, E. P. (1962). Explorations in creative thinking in the early school years. In S. J. Parnes & H. F. Harding (Eds.), *A source book for creative thinking* (pp. 363-364). New York: Scribners.

Torrance, E. P. (1966). *Torrance test of creative thinking*. Princeton, NJ: Personnel Press.

Torrance, E. P. (2000). *Research review for the Torrance tests of creative thinking: Figural and verbal forms a and b*. Bensenville, IL: Scholastic Testing Service, Inc.

Torrance, E. P., Gowan, J. C., Wu, J.-J., & Aliotti, N. C. (1970). Creative functioning of monolingual and bilingual children in Singapore. *Journal of Educational Psychology, 61*, 72-75.

Torrance, E. P., & Safter, H. T. (1999). *Making the creative leap beyond...* Buffalo, NY: Creative Education Foundation Press.

Torrance, E. P., Wu, T. H., & Ando, T. (1980). *Preliminary norms-technical manual: Demonstrator Torrance tests of creative thinking*. Athens, GA: Georgia Studies of Creative Behavior.

Townsend, J. W., Torrance, E. P., & Wu, T. H. (1981). Role of creative ability and style in the production of humor among adults. *Journal of Creative Behavior, 15*, 280.

Tropp, L. R., Erkut, S., Coll, C. G., Alarcon, O., & Garcia, H. A. V. (1999). Psychological acculturation development of a new measure for Puerto Ricans on the U.S. mainland. *Educational & Psychological Measurement, 59*, 351-367.

Tsai, J. L., Ying, Y.-W., & Lee, P. A. (2000). The meaning of "being Chinese" and "being American: Variation among Chinese American young adults." *Journal of Cross-Cultural Psychology, 31*, 302-332.

Vaid, J. (2000). New approaches to conceptual representations in bilingual memory: The case for studying humor interpretation. *Bilingualism: Language & Cognition, 3*, 28-30.

Vaid, J., & Genesee, F. (1980). Neuropsychological approaches to bilingualism: A critical review. *Canadian Journal of Psychology, 34*, 417-445.

Vernon, P. E. (1964). Creativity and intelligence. *Educational Research, 6*, 163-196.

Vincent, A. S., Decker, B. P., & Mumford, M. D. (2002). Divergent thinking, intelligence, and expertise: A test of alternative models. *Creativity Research Journal, 14*, 163-178.

Wallach, M. A. (1976). Tests tell us little about talent. *American Scientist, 64*, 57-63.

Wallach, M. A. (1986). Creativity testing and giftedness. In F. D. Horowitz & M. O'Brien (Eds.), *The gifted and talented: Developmental perspectives*. Washington, DC: American Psychological Association.

Wallach, M. A., & Kogan, N. (1965). *Modes of thinking in young children: A study of the creativity-intelligence distinction.* New York: Holt, Rinehart & Winston.

Wallbrown, F. H., & Huelsman, C. B. (1975). The validity of the Wallace-Kogan creativity operations for inner-city children in two areas of visual art. *Journal of Personality, 43*, 109-126.

Wang, R., R. (1982). *The relation between bilingualism and creative thinking.* Unpublished Doctoral dissertation, New York University.

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

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

Weisberg, R. W. (1993). *Creativity: Beyond the myth of genius.* New York: Freeman.

Whitney, C. (1974). *The relationship of bilingualism and biculturalism to divergent thinking.* Unpublished honors thesis, University of Adulate.

Wilkenfeld, M. J. (1995). *Conceptual combination: Does similarity predict emergence?* Unpublished master's thesis, Texas A&M University, College Station, TX.

Zislin, J., & Kotik-Friedgut, B. (2002). *On bilingual manifestations in psychosis.* Paper presented at the 2nd International Luria Memorial Conference "A. R. Luria's systemic-dynamic conception and neuropsychology today", Moscow, Russia.