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Attentional Processes in Low-Socioeconomic Status Bilingual Children: Are They Modulated by the Amount of Bilingual Experience?

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Recent research indicates that bilingual children are more proficient in resolving cognitive conflict than monolinguals. However, the replicability of such findings has been questioned, with poor control of participants' socioeconomic status (SES) as a possible confounding factor. Two experiments are reported here, in which the main attentional functions and pragmatic ability of 54 bilingual and 56 monolingual low-SES children were assessed (Experiment 1: 6- to 12-year-olds; Experiment 2: 6- to 8-year-olds). A language-switching task was also employed, to measure bilingual proficiency. Overall, the monolingual and bilingual groups did not differ significantly in any of the tasks employed, although the ability to resolve conflict was related to children's level of bilingual experience.

A bilingual advantage in nonlinguistic cognitive control tasks has frequently been reported in adults (e.g., Bialystok & Craik, 2010; Bialystok, Craik, Green, & Gollan, 2009; Colzato, Bajo, van den Wildenberg, & Paolieri, 2008; Costa, Hernández, & Sebastián-Gallés, 2008; Hernández, Costa, Fuentes, Vivas, & Sebastián-Gallés, 2010; Kharkhurin, 2010). Moreover, this advantage seems to emerge early in the life span. Several studies have reported better performance from bilingual children on tasks involving executive control of attention, compared to their monolingual peers (e.g., Bialystok, 2010; Bialystok & Martin, 2004; Carlson & Meltzoff, 2008; Poulin-Dubois, Blaye, Coutya, & Bialystok, 2011). This bilingual benefit has been explained by suggesting that the control mechanisms used for effective switching between languages are also deployed in tasks requiring the flexible control of attention.

There is broad agreement that both languages are activated in the bilingual mind when one of them is being used (Costa, Miozzo, & Caramazza, 1999; Gollan & Acenas, 2000; Green, 1998; van Heuven, Schriefers, Dijkstra, & Hagoort, 2008). Consequently, executive control of the two available linguistic sets is necessary so that the currently irrelevant language is inhibited and does not interfere with response selection processes. Based on this view, it could be claimed that bilinguals go through a lifetime of training in using selective attention, involving the frequent inhibition of irrelevant information, and frequent activation of relevant information, which may then generalize to other nonlinguistic tasks that tap the executive control of attention. In support of such a view, Carlson and Meltzoff (2008) noted a bilingual benefit in the executive functions used specifically in resolving conflict. The authors used a battery of executive control tasks to test monolingual and bilingual children between 4 and 6 years of age. Specifically, several of the tasks tapped inhibition of attention, including the Advanced Dimensional Change Card Sort task (Hongwanishkul, Happaney, Lee, &

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Zelazo, 2005), Visually Cued Recall task (Zelazo, Jacques, Burack, & Frye, 2002), Simon says task (Strommen, 1973), and the child version of the Attentional Networks Task (ANT; Rueda, Fan, et al., 2004). Overall, bilingual children outperformed monolinguals, though not on all tasks tapping inhibition (including the ANT and the Simon says task). This was taken as evidence for the specificity of the bilingual benefit. That is, the authors suggested that bilingual experience may enhance the ability to inhibit misleading stimuli (*cognitive* inhibition) though not to inhibit incorrect responses (*response* inhibition; Carlson & Meltzoff, 2008).

These studies suggest that the development of attentional control may be modulated by bilingualism. This is an important issue, given that complex cognitive abilities such as self-regulation and cognitive flexibility depend on core attentional functions (Rueda, Posner, and Rothbart, 2004). These core functions include the ability to allocate attention to relevant objects or locations (orienting), to maintain a state of readiness that allows rapid responses to relevant events (alertness), and to select the most goal-relevant response (executive control). Thus, there is a clear need for further research to determine how these basic attentional functions develop in bilingual environments. However, such research must also take adequate notice of other cognitively salient features of these environments.

Notably, socioeconomic status (SES) is likely to be particularly important in this regard, as it represents a potentially confounding factor that could account for at least some of the apparent differences between bilinguals and monolinguals. High SES is associated with beneficial cognitive effects, so a failure to control for this would make it hard to disentangle the influences of bilingualism on cognition from those of SES. However, many of the studies that report a bilingual advantage did not adequately assess or control for participants' SES (e.g., Bialystok, 1986, Experiment 1; Bialystok & Martin, 2004; Bialystok & Senman, 2004, Experiment 2; Costa et al., 2008; Hernández et al., 2010). This observation was further supported by a meta-analysis that concluded that there was a general lack of information about SES in bilingualism studies (Adesope, Lavin, Thompson, & Ungerleider, 2010). The authors also reported that when information about SES of the bilingual participants was available, it usually indicated either mixed or higher SES in this group, relative to the monolingual group.

Similarly, developmental studies supporting a bilingual cognitive advantage over monolinguals also suffer from inadequate control of SES. For example, Morton and Harper (2007) raise the possibility that bilingual and monolingual groups in certain studies (e.g., Bialystok, 1986; Experiment 1; Bialystok & Martin, 2004; Bialystok & Senman, 2004; Experiment 2) come from very different socioeconomic groups. Specifically, the bilingual children in these studies come from immigrant Canadian families whose educational level is on average higher than that of monolingual Canadian families (PCEIP; Statistics Canada, 2003). This leaves open the possibility that the reported bilingual advantages may be at least partly attributable to the higher SES of the bilingual participants. This is a particular concern for studies investigating the links between bilingualism and attention control, given the crucial influence of SES on the development of attention (e.g., Kochanska, Murray, & Harlan, 2000; Linver, Brooks-Gunn, & Kohen, 2002; Mezzacappa, 2004). There is empirical evidence to support this contention: When bilingual and monolingual children were matched for SES, no between-group differences were found on the Simon conflict task in 6- and 7-year-olds (Morton & Harper, 2007). This conclusion has been further supported by a study conducted by Duñabeitia et al. (2014) with a relatively large sample of bilingual and monolingual children ($N = 252$ in each group), well matched for SES. The authors did not replicate the bilingual advantage in two different versions of the Stroop task. Similarly, in two very recent separate studies, Gathercole et al. (2014) and Antón et al. (2014) both failed to replicate the bilingual advantage in children. Tasks used included the card-sorting task, a grammatical judgment task, and the Simon task (Gathercole et al., 2014), and the ANT child (Antón et al., 2014). In both studies, the two groups were adequately matched for SES. In a similar vein, Paap and Greenberg (2013) examined young adult bilinguals and monolinguals in a series of experiments employing tasks typically considered to tap executive processes that benefit from bilingualism, such as inhibitory control, monitoring, and switching. However, the authors failed to find any bilingual advantage in those functions. Thus, these recent studies suggest that the bilingual benefit may have been overestimated in previous studies with children and adults, or perhaps that there has been a publication bias toward positive findings in the field of bilingualism and cognition.

While sample differences *between* bilingual and monolingual participants are clearly important, we should not neglect potential differences *within* bilingual participant groups either. Being bilingual is

not a homogenous phenomenon. Despite this, many studies of bilingualism have neglected to adequately address participants' degrees of proficiency in both languages. The influence of bilingualism on a cognitive system will vary according to how often the individual uses both languages, and how familiar each language is (Bialystok, 2009). Many studies have made the assumption that their participants were balanced bilinguals, based on self-report measures that participants used both languages regularly (e.g., Garratt & Kelly, 2008). However, the subjectivity of such self-report measures is widely known and may seriously undermine their reliability (for a review of this topic, see Mindt et al., 2008). This is likely to be all the more important in young children, who have not received substantial formal education, and thus may use mainly one language (the language that is used mostly at home). More objective measures of bilingualism are possible, notably by assessing the amount of asymmetry in costs between switching from one language to the other. According to Meuter and Allport (1999), the magnitude of the asymmetrical switch cost elicited in a language-switching task depends on the dominance level of each language. Thus, we would expect response times (RTs) for trials switching back to Language 1 (L1) to be greater than RTs for trials switching back to Language 2 (L2) if the participants were L1-dominant bilinguals. If participants were balanced bilinguals, however, no switch-cost asymmetry (SCA) should be observed. To our knowledge, ours is the first study to employ a language-switching task as a measure of bilingual proficiency.

The present study aims to investigate for the first time the effect of bilingualism on the three main attention functions (alerting, orienting, and attentional control) in low-SES children. Low-SES groups have been largely neglected in research into the cognitive effects of bilingualism, despite the fact that low-SES bilinguals constitute the majority of the bilingual population in Balkan countries like Greece, where most bilinguals are economic migrants. A further innovation of this study is the use of a language-switching task as an objective index of level of bilingualism.

Experiment 1

The present experiment employed the child version of the ANT to investigate the effect of bilingualism on attentional function (orienting, alerting, and executive control). The ANT was specifically chosen as it is a relatively short task, with good test–retest reliability (Fan, Wu, Fossella, & Posner, 2001), which assesses the three main functions of attention (executive, alerting, and orienting). A further advantage is that the task is free of language and working memory (WM) influences (Costa et al., 2008; Posner & Fan, 2007). This task has been widely used with different populations including children (Mezzacappa, 2004; Rueda, Fan, et al., 2004; Rueda, Posner, et al., 2004), healthy adults (Fan, McCandliss, Sommer, Raz, & Posner, 2002; Fan, Wu, et al., 2001), and adults with psychopathology (Posner et al., 2002), and there is substantial evidence regarding the brain areas (Fan, McCandliss, Flombaum, & Posner, 2001; Fan, McCandliss, Flombaum, Thomas, & Posner, 2003), and genes (Fossella et al., 2002) underlying the attentional functions measured by the ANT. Finally, the ANT has revealed bilingual additive effects in adult executive attention (Carlson & Meltzoff, 2008; Costa, Hernández, Costa-Faidella, & Sebastián-Gallés, 2009; Poarch & van Hell, 2012), suggesting that it may measure the attentional processes most relevant to bilingualism.

To avoid the possible masking of bilingual effects on attention by between-group SES influences, only low-SES children were included in the present study (in line with a previous suggestion by Carlson & Meltzoff, 2008; and de Abreu, Cruz-Santos, Tourinho, Martin, & Bialystok, 2012). Although a general bilingual advantage on executive control of attention in children has frequently been claimed, to our knowledge ours is the first study to investigate the alerting and orienting processes of attention in low-SES bilingual children, with only one very recent study (Antón et al., 2014) testing whether these functions are influenced by bilingualism though not with specifically low-SES children. In adults, evidence on bilingual influences in alerting is not conclusive, with a bilingual benefit reported by one study (Costa et al., 2008), but not another (Costa et al., 2009). For the orienting of attention, evidence is also limited and somewhat inconsistent, with one study showing a bilingual effect on visuospatial attention (Colzato et al., 2008) and two other studies showing no such effect (Costa et al., 2008; Hernández et al., 2010).

In addition to a standard self-report measure, we also employed a version of the language switching task (Meuter & Allport, 1999) as an index of bilingual language proficiency. We expected a positive correlation between the asymmetry of the switch cost and the ability of bilingual children to resolve conflict. That is, the more balanced the bilingual

children, the smaller the magnitude of the conflict effect in the ANT.

Method

Participants

Twenty-six Greek-Albanian bilingual children (16 males, 10 females) and 24 Greek monolingual children (6 males, 18 females) participated in the study. All participants were second-generation Albanian immigrants, according to the definition of Gogonas (2009) and Thomson and Crul (2007; i.e., either born in Greece after their parents migrated to Greece, or came to Greece before attending primary school). Information on the social and linguistic context of our bilingual participants follows: According to the 2001 Greek census, almost 60% of the 800,000 migrants in Greece were Albanian, and this percentage has risen in recent years. The Albanian language is historically and qualitatively related to Greek, as a dialect called Arvanitika was used by Greek people during the past century in Thebes, Athens, the Peloponnese and some Greek islands, and is directly related to the Albanian language (Sella-Mazi, 2001; Trudgill, 2002). Regarding our bilingual participants, according to the parental self-reports, Albanian was the native language of all children and the first one learned in the family environment. According to the children's self-reports, they all used Albanian to talk with their parents and other relatives, apart from their siblings with whom they mostly used Greek as well as with their friends and peers. None of the bilingual children had ever received formal education in the Albanian language, in contrast to Greek, which was the language used at school. Finally, the vast majority (98%) of the bilingual children rated themselves as highly proficient in speaking and understanding both Albanian and Greek, as well as reading and writing in Greek, whereas they perceived themselves as "good" in reading Albanian, and 24% perceived themselves as "poor" in writing in Albanian. Ages ranged from 6 to 12 years (bilingual mean = 9.3 years, monolingual mean = 9.4 years). The inclusion criteria for participants were that they had: (a) a background of parental low SES (as assessed by the Demographics and Language Background questionnaire), (b) a general IQ score within the normal range, and (c) Greek ethnicity, and spoke only Greek at home and at school (for monolingual participants), or Albanian ethnicity, spoke Albanian and Greek approximately equally in everyday life, and had been exposed to both languages from 2 years of age or earlier (for bilingual participants).

The two groups were matched in age, IQ scores, vocabulary, and SES (see Table 1). Also, there were no significant differences between the scores in the Greek and Albanian vocabulary subscale of the Weschler Intelligence Scale for Children (WISC) in the bilingual group. All children were recruited from two public schools in the center of Thessaloniki, and their parents provided a signed consent

Table 1
Summary of Participants' Ages, SES Level, WISC Vocabulary, and Raven's CPM Raw Scores in the Monolingual and Bilingual Groups in Experiments 1 and 2

	Experiment 1		Experiment 2	
	Monolingual *M* (*SD*)	Bilingual *M* (*SD*)	Monolingual *M* (*SD*)	Bilingual *M* (*SD*)
Age (in years)	9.43 (1.46)	9.28 (1.57)	6.44 (0.82)	6.77 (0.56)
	Min age 6	Min age 7	Min age 6	Min age 6
	Max age 11	Max age 11.5	Max age 7.7	Max age 7.8
SES[a]	5.27 (1.2)	4.85 (1.1)	3.09 (0.52)	2.89 (0.67)
	Min SES 3	Min SES 3	Min SES 2	Min SES 2
	Max SES 7	Max SES 7	Max SES 4	Max SES 4
Mean parental years of education	—	—	9.05 (1.81)	8.36 (2.02)
G–WISC Voc[b]	25.44 (12.03)	19.88 (8.76)	11.13 (4.93)	10.75 (5.41)
A–WISC Voc[c]	—	21.38 (7.64)	—	11.57 (4.06)
Raven's CPM	28.27 (6.27)	26.23 (5.92)	20.13 (6.38)	20.00 (4.64)

Note. All *p*s > .05. SES = socioeconomic status; WISC = Weschler Intelligence Scale for Children; CPM = Coloured Progressive Matrices. [a]SES: 2 to 7 = low SES, 8 to 12 = middle SES, ≤ 13 = high SES. [b]G–WISC Voc = raw scores on the Geek version of WISC Vocabulary subscale. [c]A–WISC Voc = raw scores on the Albanian version of WISC Vocabulary subscale.

form. As an incentive, child participants were given two colorful pencils after completing the experimental tasks (one in the middle of the experimental procedure and one at the end).

Materials and Procedure

Self-report measures and cognitive tests. Raven's Colored Progressive Matrices (Raven, Court, & Raven, 1990) and the Greek version of the expressive Vocabulary subtest of the WISC–Version III (Wechsler, 1991) were used to match bilingual and monolingual children on intelligence and verbal ability. Since the WISC–III has not been validated in Albanian, the Vocabulary subtest was translated and back-translated by psychologists who were bilingual in Greek and Albanian.

SES level, language use, and language skill. Level of SES was assessed using the Demographics and Language Background questionnaire (see the Appendix, for details), a new measure based on similar questionnaires used in previous studies of bilingualism (Abedi, Lord, & Plummer, 1997; Costa et al., 2008; Garratt & Kelly, 2008; Gullberg & Indefrey, 2003). Where appropriate, questions were translated from Greek to Albanian by a native Albanian psychologist proficient in Greek. The ratings on these questionnaires are not influenced by the language of the items included (Delgado, Guerrero, Goggin, & Ellis, 1999).

The educational level (e.g., "For how many years did you attend school?" and "Did you attend any school after finishing 12 years of formal education?") and occupational status (e.g., "What is your occupation?" and "What is your exact position in this occupation?") of both parents were assessed as indicators of familial SES. Total scores were then divided by 2 to obtain a mean final SES score (2–7 = low SES, 8–12 = middle SES, > 12 = high SES). Maternal and paternal education level and occupational status have been used extensively as indicators of SES of Canadian (Calvo & Bialystok, 2014) and Greek (for a review, see Economou & Nikolaou, 2005) participants, since work salary, and hence income, is considered to be an index of these two factors. Initially, we had included also a question on annual income, but parents refused to answer this question during the pilot study and reported that it was too personal. The classification, and thus scoring, of occupational status was made according to the occupational classification of the Hellenic Statistical Authority for 2010.

Language use and *language skill* were measured with questions referring to: language use and frequency at home and at school, the child's level of language proficiency in both languages, and the way languages were taught, officially (i.e., attending language classes) or unofficially (i.e., by the parents and/or relatives living together at home; see the Appendix). Similar items have been previously used by studies with Albanian-Greek bilingual children, to estimate their sociolinguistic background (Gogonas, 2009).

Computerized tasks. Both the ANT (child version) and the language-switching task were presented on a 15-in. laptop PC, running E-Prime 1.1 (2002) software (E-Prime, Sharpsburg, MD). The experiments were created with the E-Prime software and responses were recorded either via a computer mouse (ANT) or via a voice key (language-switching task). Each child was tested individually in a quiet classroom at their school. The order of task administration was counterbalanced for all participants. For both computerized tasks, instructions were given verbally by the experimenter. When children indicated that they had understood the instructions, the practice trials began.

The ANT (child version). A child version of the ANT was adapted from that used for adults (see Rueda, Fan, et al., 2004; Rueda, Posner, et al., 2004). It was similar to the adult version of the ANT, with the only difference being in the stimuli used. Instead of arrows as target and flankers, yellow fish were used. Children were told that sometimes a fish would appear on its own, and sometimes it would appear with other fish, and that they had to feed only the hungry fish at the center of the row. If the fish pointed to the right, they should feed it with a right click of the mouse and if the fish pointed to the left, they should feed it with a left click of the mouse. There were three kinds of trial. On neutral trials, only the central fish appeared. On congruent trials, the flanking fish pointed in the same direction as the central fish. On incongruent trials, the flanking fish pointed in the opposite direction to the central fish. Each trial started with a fixation cross at the center of the screen. Children were told to keep their eyes on the fixation cross throughout the experiment. Then, a warning cue appeared for 150 ms. After an interval of 450 ms, the target array was presented above or below the fixation point for 1,700 ms, or until response. There were four different types of warning cue used. These were: spatial cue, double cue, no cue, and central cue. In the Spatial cue condition, an asterisk was presented at the upcoming location of the target fish. In the double cue condition, two asterisks (one above and one below

fixation) were presented prior to the target appearing. The no cue and central cue conditions were control conditions for the double cue and spatial cue conditions, respectively.

There were 24 practice trials, followed by 3 experimental blocks of 96 trials each. There were 12 conditions overall, created by fully combining flanker congruency (congruent, incongruent, or neutral) and warning cue type (no cue, central cue, double cue, or spatial cue). There were 24 trials for each of the 12 conditions.

The language-switching task. This computerized task required participants to read aloud a series of digits in either Albanian or Greek, according to the type of flag shown on screen for that trial. Stimuli were yellow numerals from 1 to 9. The numbers were presented one at a time in a random order, on a background showing either an Albanian flag or a Greek flag. Stimuli remained on the screen until response, and the intertrial interval was 400 ms. Responses were recorded via a microphone connected to a voice key. The task consisted of one practice block of 18 trials, followed by two experimental blocks of 36 trials each. Only switch trials were used (i.e., trials where children had to respond in a different language from the one used in the previous trial). On half of the trials in each block, therefore, participants responded in L1 (i.e., their native language, Albanian), and on the other half they responded in L2 (i.e., Greek). Children were encouraged to respond as quickly and accurately as possible. Only bilingual children completed this task.

Results

The ANT Child

Error analysis. Mean percentages of correct responses were submitted to a 3 × 4 × 2 mixed analysis of variance (ANOVA) with flanker type (congruent, incongruent, neutral) and cue type (double, no, central, spatial) as the within-subjects factors, and language group (monolingual, bilingual) as the between-subjects factor. No main effects or interaction reached statistical significance.

RT analysis. Mean correct RTs were submitted to a 3 × 4 × 2 mixed ANOVA with flanker type and cue type as within-subjects factors, and language group as a between-subjects factor (see Table 2). There were significant main effects of flanker type, $F(2, 276) = 134.69$, $p < .00001$, $\eta^2 = .745$, and cue type, $F(3, 276) = 76.79$, $p < .00001$, $\eta^2 = .625$. Bonferroni post hoc comparisons indicated significant differences between the incongruent condition (751 ms) and both the congruent (672 ms) and neutral (647 ms) conditions, $p < .0001$, and between the congruent condition and the neutral condition, $p < .0001$. That is, there was an overall conflict effect of 79 ms (computed by subtracting congruent RTs from incongruent RTs). There were also significant differences found between the spatial cue condition (652 ms) and the central cue condition (696 ms), as well as between the double cue condition (669 ms) and the no cue condition (743 ms), ps $< .0001$. That is, there was a significant overall alerting effect of −74 ms (computed by subtracting no cue RTs from double cue RTs) and a significant overall orienting effect of −44 ms (computed by subtracting central cue RTs from spatial cue RTs). No other effects or interactions reached statistical significance.

As executive processes are still sensitive to changes during childhood (e.g., Carlson, 2003), and the age range of our sample was from 6 to 12 years old, we submitted the data to a further 3 × 4 × 2 mixed analysis of covariance with age as the covariate. Again, there were significant main effects of cue, $F(3, 270) = 3.03$, $p = .032$, $\eta^2 = .063$, and flanker, $F(2, 270) = 15.04$, $p < .00001$, $\eta^2 = .251$.

Table 2
Mean Response Times and Standard Deviations as a Function of Language Group, Cue Type, and Flanker Type in Experiment 1

		Cue type			
Flanker type	Language group	No cue *M* (*SD*)	Central cue *M* (*SD*)	Double cue *M* (*SD*)	Spatial cue *M* (*SD*)
Congruent	Monolinguals	708 (143)	657 (152)	633 (159)	609 (158)
	Bilinguals	753 (153)	694 (144)	666 (120)	658 (119)
Incongruent	Monolinguals	764 (154)	727 (182)	709 (181)	688 (181)
	Bilinguals	819 (146)	786 (152)	758 (129)	754 (151)
Neutral	Monolinguals	700 (173)	642 (179)	609 (133)	659 (118)
	Bilinguals	716 (132)	667 (122)	639 (119)	631 (126)

Additionally, there was a significant interaction between cue type and flanker type, $F(6, 270) = 3.03$, $p = .007$, $\eta^2 = .063$, after controlling for the effect of age. Bonferroni post hoc comparisons showed significant differences between the incongruent and neutral conditions in all cue conditions (interference effects of 86, 110, 103, and 121 ms for the no cue, double cue, central cue, and spatial cue conditions, respectively), ps < .0001. Also, there were significant differences between the incongruent and the congruent conditions in all cue conditions (interference effects of 62, 84, 82, and 89 ms for the no cue, double cue, central cue and spatial cue conditions, respectively). Finally, there were significant differences between the congruent and neutral conditions for the no cue (732 ms vs. 708 ms), double cue (651 ms vs. 625 ms), and spatial cue (635 ms vs. 603 ms) conditions, ps < .05.

Language-Switching Task

The standard deviations of the mean language-switching RTs were high (M = 1,375 ms, SD = 738 for switch-to-L1 condition; M = 1,078 ms, SD = 454 for switch-to-L2 condition). Thus, a square root transformation was used to normalize the distribution of scores. Subsequent analyses showed significant differences between switch-to-L1 trials (M = 36.01, SD = 9.01) and switch-to-L2 trials (M = 32.41, SD = 6.29), $t(24) = 3.765$, $p = .001$. Thus, there was a significant overall asymmetrical switch cost.

To allow us to study separately the three attentional networks assessed by the ANT, discrete scores were computed for each network (conflict score = incongruent RTs − congruent RTs; alerting score = double cue RTs − no cue RTs; orienting score = spatial cue RTs − central cue RTs). To test the relations between these three networks and the degree of bilingualism (as assessed by the language-switching task), we employed a score of the absolute SCA (mean switch-to-L2 RTs were subtracted from mean switch-to-L1 RTs). That is, an absolute SCA of 0 would mean that the participant is a fully balanced bilingual. A Pearson correlation was then computed with the transformed data (a square root transformation in the SCA data). The significance level was adjusted with a Bonferroni correction for multiple comparisons (alpha level = .013). Contrary to our prediction, there was no significant correlation between SCA and the conflict effect. There was, however, a significant positive correlation between alerting and the orienting scores, $r(24) = .995$, $p < .00001$. When the same analyses were repeated controlling for age, there was a significant correlation between SCA and conflict, $r(23) = .425$, $p = .017$ (see Figure 1). The correlation between alerting and orienting remained after controlling for age, $r(23) = .995$, $p < .00001$.

Discussion

Experiment 1 investigated the effect of bilingualism on attentional function in carefully matched groups of low-SES participants. There were no significant differences between monolingual and bilingual participants in any of the three attentional functions (conflict, orienting, and alerting). These findings are somewhat at odds with previous studies that reported a bilingual advantage in other tasks of cognitive control in children of low SES (de Abreu et al., 2012), as well as a study supporting an independent additive effect of both bilingualism and SES on cognition (Calvo & Bialystok, 2014). However, they are entirely consistent with previous research with SES-matched bilingual and monolingual children, in which the absence of a bilingual effect on the Simon task (Gathercole et al., 2014; Morton & Harper, 2007), two versions of the Stroop task (Duñabeitia et al., 2014), and the ANT child (Antón et al., 2014) was reported. We will return to the relation between SES and bilingualism in the General Discussion.

The absence of a bilingualism effect in our sample may simply reflect that the mechanisms involved in switching between languages do not significantly overlap with the attentional processes assessed by the ANT. Alternatively, however, the

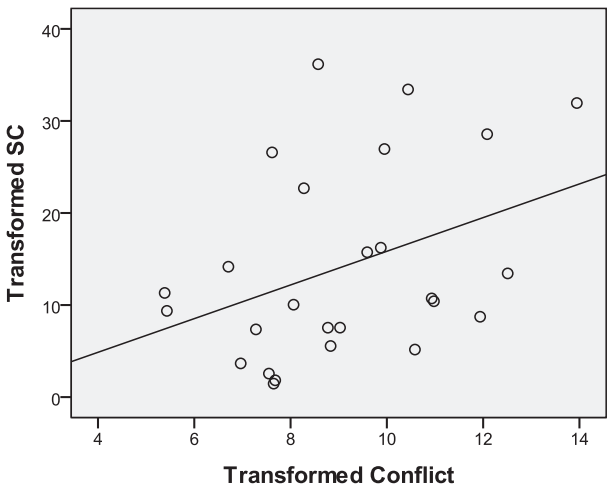

Figure 1. The significant correlation between switch cost (SC) and the conflict effect, both reflecting the executive control of attention function, after controlling for age.

absence of effect could instead be related to specific characteristics of our sample. To our knowledge, this was the first study to employ a language-switching task as an objective measure of bilingual language proficiency. In support of the importance of using objective measures of bilingualism, we found that the results from the number switching task did not fully accord with parental-report measures of language proficiency. Thus, although all parents reported that their children were balanced in both languages, there was an overall asymmetrical switch-cost effect: Children took longer to switch from L2 (Greek) to L1 (Albanian) than to switch from L1 to L2. As the speed with which one retrieves a word (i.e., lexical retrieval) is one of the main components of lexical proficiency (Meara, 2005), and lexical proficiency in turn is an important component of language proficiency especially for bilinguals (Crossley, Salsbury, McNamara, & Jarvis, 2011), this finding suggests that our bilingual participants were not balanced bilinguals because they were not equally fast or proficient in retrieving, and thus naming, digits from both languages. If we assume that bilingualism is like any other training experience (Bialystok, 2009), then it may be that the bilingual advantage is attenuated, or even absent, in children who are not balanced bilinguals. These children may well not use both languages equally, and will therefore have less training in switching between languages. This hypothesis is wholly consistent with the significant correlation between the SCA and the magnitude of the conflict effect in the bilingual group when controlling for age. That is, the more balanced the bilingual children were (i.e., the smaller their SCA), the faster they resolved conflict in the ANT task. Finally, the absence of a relation between SCA and alerting as well as with orienting of attention likely indicates that the locus of the bilingual effect in attention lies in the executive attention network, and not in other attentional functions.

Experiment 1 suggests that when bilingual and monolingual participants are matched to have low SES, the "bilingual effect" often cited in studies of attentional function is hampered. However, there does seem to be a relation between the degree of bilingual experience (as measured by the asymmetry of switch cost), and the ability to resolve conflict. The more balanced a bilingual is, the faster he or she can resolve conflicting information. Experiment 2 follows up this finding. Since Experiment 1 involved participants with a relatively broad age range, and this correlation was found only after controlling for age, our second experiment was conducted with a narrower age range of 6- and 7-year-olds. This is a particularly relevant age group to study, not least because it has been noted that attentional networks continue to develop until at least 7 years of age (Rueda, Rothbart, McCandliss, Saccomanno, & Posner, 2005).

Experiment 2

In this experiment, we aimed to test whether a bilingual advantage would be found on a cognitive task more closely related to the bilingual experience —specifically, the scalar implicature (SI) task (Siegal, Matsuo, & Pond, 2007). This is a language-based task that involves more general executive control abilities, including WM and shifting attention between linguistic representations. In this task, participants are asked to judge how well a particular sentence describes a scene. On all trials, a sentence is presented (e.g., "Some women are blonde") involving the weak item (*some*) of a set of ordered alternatives (*some; most; all*) called a scale, to imply that the strongest item of that scale is not true (*all*), hence the term SIs (e.g., "Some women are blonde" implies that "Not all women are blonde"). To respond correctly in the SI task, one must flexibly shift attention from the semantic to the pragmatic meaning of a sentence (Katsos & Bishop, 2011), and simultaneously hold in WM the stronger, alternative scalar term of the scale used in that sentence (De Neys & Schaeken, 2007).

Very few studies have investigated the relation between bilingualism and SIs. However, there is some evidence that bilingual children outperform monolinguals in SI tasks (Siegal et al., 2007; Slabakova, 2009). Specifically, bilingual children's ability to derive SI was superior to that of monolinguals, even though the bilingual children did not outperform their monolingual peers in executive function tasks (Siegal et al., 2007). The authors suggested that bilingual children may be more pragmatically skilled than monolinguals, since they are exposed to more linguistic and conversational information. It could be the case then that Experiment 1 failed to detect a bilingual attentional benefit because the bilingual effect actually lies in pragmatic ability and not in attention per se, as also suggested by Siegal et al. (2007). Studies looking at the influence of bilingualism on pragmatic competence more generally (Siegal, Iozzi, & Surian, 2009; Siegal et al., 2010; Surian, Tedoldi, & Siegal, 2010) have indeed indicated a bilingual advantage. Moreover, the SI task is considered to be a metalinguistic task (Siegal

et al., 2010) and bilingual children have been previously reported to outperform their monolingual peers in other metalinguistic tasks (e.g., Bialystok, 1988). In common with many other studies of bilingualism, however, none of these studies matched monolingual and bilingual participants on SES, so the potential contributions of bilingual status and SES remain to be disentangled.

In addition to the SI task, we also included the ANT and the language-switching task, to allow us to test whether the findings of Experiment 1 would replicate in a sample with a much narrower age range. If so, performance of bilingual and monolingual children on the ANT should be similar. Previous research would suggest that bilingual children should outperform monolingual children on the SI task. However, the novel contribution of the present study is that participants in our sample are matched for SES, which removes a potential confound with bilingualism, and may therefore reveal a different pattern of performance. Finally, we expect SCA on the number-switching task to be related to children's ability to resolve conflict in the ANT, as well as to bilingual children's pragmatic competence.

Method

Participants

Inclusion criteria were identical to Experiment 1, except that the age range was narrowed to between 6 and 8 years of age. The monolingual group comprised 32 Greek children (14 boys, 18 girls), and the bilingual group comprised 28 Greek-Albanian children (13 boys, 15 girls). All children were recruited from public schools, as in Experiment 1, from villages near Xanthi, a city in Northern Greece. Both groups were matched for age, IQ, expressive vocabulary, and SES (see Table 1). As in Experiment 1, all bilingual children were second-generation Albanian students (Gogonas, 2009; Thomson & Crul, 2007).

Parental years of education has been suggested to be a crucial factor in determining SES (Davis-Kean, 2005), particularly influencing children's cognitive abilities in low-SES environments (Rowe, Jacobson, & Van den Oord, 1999). An independent t test found no difference between bilingual (M = 8.36, SD = 2.02) and monolingual (M = 9.05, SD = 1.81) groups in mean parental years of education, $t(58) = 1.397$, $p = .168$. The parental language self-report questionnaire indicated that bilingual children were skilled in a second language and exposed to L2 (i.e., Greek) from early on (see the Appendix) and that Albanian (i.e., L1) was the children's first-learned and native language. Parents further reported that, similar to Experiment 1, Albanian was the native language of all children and the first one learned in the family environment. According to the children's self-reports, they all used Albanian to talk with their parents and most other relatives. However, they mostly used Greek to talk with their siblings, friends, and peers. None of the bilingual children had ever received formal education in the Albanian language, as opposed to Greek, which was the language used at school. Finally, the vast majority (96.7%) of the bilingual children rated themselves as highly proficient in speaking, understanding, and reading in both Albanian and Greek, whereas 32% perceived themselves as "poor" in writing in Albanian.

Materials and Procedure

The experimental procedure was similar to Experiment 1, with the addition of the SI task. Also, there was a minor modification in the ANT child relative to the one used in Experiment 1. Instead of a double asterisk, an auditory high-frequency tone of a short duration was used as the alerting cue. This change was made to enable more independent assessment of the three networks of attention, as now a different stimulus (i.e., an asterisk for the orienting function, an auditory cue for the alerting function, and arrows for the executive attention function) was used to assess each attention network (Callejas, Lupiáñez, & Tudela, 2004).

The SI task. A version of Papafragou and Musolino's (2003) SI task was used, in which children judge how well a sentence describes a given scenario. This task has been shown to be appropriate for measuring the pragmatic competence of Greek children. Two types of scales were used: (a) a scale with terms of quantity (i.e., *all, some*; in Greek *ola, merika)* and (b) a scale with initiation/finalization terms (i.e., *start, finish;* in Greek *arxise, teliose*). Thus, children were tested on how well they interpreted two types of scalar terms: *some* and *start*. These terms were presented in the following sentences:

1. *Some* of the horses jumped over the fence.
2. The girl *started* making the puzzle.

However, the actual videotaped stories that were presented were more accurately described by the stronger term of each scale:

3. *All* of the horses jumped over the fence.
4. The girl *finished* making the puzzle.

For example, in the story for sentence (1), *all* horses managed to jump over the fence. Thus, sentence (1), although partially true, is pragmatically infelicitous for describing that story, as it implies that not all horses jumped over the fence. Instead, sentence (3) should have been used. If children correctly interpret this implicature, they should respond that (1) was not a good way of describing the corresponding story. They should also add, when asked, that expression (3) should have been used instead. The same logic underlies the other statement. Thus, we expected that if children were sensitive to the SIs used in statements (1) and (2), they would respond that these statements are not a good way to describe the stories where (3) and (4) are depicted.

For the presentation of the task to children, a hand puppet ("Mr. Frog"), manipulated by the experimenter, was introduced to the child. The training phase consisted of two training trials, as follows: The puppet was shown a toy tree. The experimenter asked the puppet, "What is this, Mr. Frog?" to which the puppet replied "It's a tree." The experimenter then asked the child, "Did Mr. Frog give a good answer?" Then, the puppet was shown a toy pig and when asked what it was, replied, "It's a dog." The experimenter again asked the child if Mr. Frog had given a good answer. If the child could not provide a correct response when asked, the experimenter said, "Mr. Frog did not give a good answer. This is a pig." These training scenarios were used to ensure that children would critically consider the puppet's statements to decide whether what was said was true or not, instead of assuming that everything Mr. Frog says was wholly true or wholly false.

For the testing phase, children were shown videotaped scenarios in which toys were completing a task (see Table 3). The procedure was similar to the training phase, with the exceptions that the stories were played on the video and that no feedback was given to the child. The experimenter said, "Now, shall we watch some stories and see whether Mr. Frog gives good answers?" The video was played, showing one of the stories described in Table 3. After each scenario, the video was stopped and the experimenter asked Mr. Frog what he thought had happened in the story. The puppet answered using the terms presented in Table 3, and children were asked whether he had given a good answer. In cases where the child provided an alternative good answer to Mr. Frog's response, this was manually recorded by the experimenter.

As can be seen in Table 3, all test trials were designed to elicit a "no" response from the child. Thus, to balance out "yes" and "no" responses, as well as to ensure that the child could correctly accept or reject the puppet's statements, control trials were also included in the task (also shown in Table 3). Control trials and test trials were presented alternately.

Results

The ANT Child

Error analysis. Mean percentages of correct responses were submitted to a 3 × 4 × 2 mixed ANOVA with flanker type (congruent, incongruent, neutral) and cue type (alerting cue, no cue, central cue, spatial cue) as within-subjects factors and language group (monolingual, bilingual) as a between-subjects factor. There were significant main effects of flanker type, $F(2, 116) = 17.33$, $p < .0001$, $\eta^2 = .230$, and cue type, $F(3, 174) = 3.19$, $p = .025$, $\eta^2 = .052$. Bonferroni post hoc comparisons showed that performance in the incongruent condition (91%) was significantly different from that in both the congruent (96%), and neutral (96%) conditions, ps < .0001. There was also a borderline-significant difference between the alerting cue (95%) and central cue (93%) conditions, $p = .054$.

RT analysis. Mean correct RTs were submitted to a 3 × 4 × 2 mixed ANOVA, with flanker type and cue type as within-subjects factors, and language group as a between-subjects factor (see Table 4). There were significant main effects of flanker type, $F(2, 116) = 121.18$, $p < .00001$, $\eta^2 = .676$, and cue type, $F(3, 174) = 38.21$, $p < .0001$, $\eta^2 = .397$. These effects were further modulated by a significant Cue × Flanker interaction, $F(6, 348) = 2.55$, $p = .020$, $\eta^2 = .042$. To further investigate this interaction, Bonferroni post hoc comparisons were conducted for the congruency factor in each level of cue type. Results showed significant differences between the incongruent and congruent conditions (conflict effects) in all cue conditions (conflict effects of 67, 100, 95, and 101 ms for the no cue, double cue, central cue, and spatial cue conditions, respectively), ps < .0001. That is, as in Experiment 1, there was a smaller in magnitude conflict effect for the no cue condition. Also, there were significant differences between the incongruent and the neutral conditions in all cue conditions (interference effects of 96, 150, 117, and 121 ms for the no cue, double cue, central cue and spatial cue conditions, respectively). Finally, there were significant differences between the congruent and neutral conditions for the no cue (826 ms vs. 833 ms) and

Table 3
Description of Stories Depicted in the Video for the Scalar Implicature Task and Puppet's Statements That the Children Are Asked to Judge in Experiment 2

Scalar terms	Story shown on video	Puppet's statements
{*all, some*}	All horses jumped over the log.	Some horses jumped over the log.
{*ola, merika*}	All rabbits went in the house.	Some rabbits went in the house.
	All dinosaurs ate trees.	Some dinosaurs ate trees.
	All playmobils bought dogs.	Some playmobils bought dogs.
{*start, finish*}	The tiger finished painting the balloons.	The tiger started painting the balloons.
{*arxise, teliose*}	The tiger finished putting the cars into the bag.	The tiger started putting the cars into the bag.
	The little girl finished making the puzzle.	The little girl started making the puzzle.
	The little girl finished eating her food.	The little girl started eating her food.
Control trials	The tiger bought some of the balloons.	The tiger bought some balloons.
(all, some)	The strong man lifted some of the bags.	The strong man lifted some bags.
	Donald found some of the animals.	Donald found some animals.
	Donald played with some of the cars.	Donald played with some cars.
Control trials	Donald started putting the pens into the pencil-case.	Donald started putting the pens into the pencil-case.
(start, finish)	Donald started cleaning the table.	Donald started cleaning the table.
	The little girl started painting the picture.	The little girl started painting the picture.
	The little girl started drinking water.	The little girl started drinking water.

Table 4
Mean Response Times and Standard Deviations as a Function of Language Group, Cue Type, and Flanker Type in Experiment 2

		Cue type			
Flanker type	Language group	No cue *M* (*SD*)	Central cue *M* (*SD*)	Alerting cue *M* (*SD*)	Spatial cue *M* (*SD*)
Congruent	Monolinguals	868 (158)	830 (164)	807 (165)	770 (194)
	Bilinguals	855 (137)	787 (140)	791 (146)	759 (160)
Incongruent	Monolinguals	937 (144)	908 (157)	910 (163)	878 (160)
	Bilinguals	921 (138)	898 (165)	888 (151)	854 (159)
Neutral	Monolinguals	845 (156)	796 (164)	747 (151)	767 (168)
	Bilinguals	821 (126)	776 (145)	751 (130)	724 (142)

double cue (799 ms vs. 749 ms) conditions, $ps < .05$.

Similar to Antón et al. (2014), to make sure that there was no bilingual effect in children's performance in the ANT child that may have been masked by their age differences, we conducted a full analysis of each attention network separately, including language group (monolinguals and bilinguals) and age group (age 1 from Experiment 1 and age 2 from Experiment 2) as between-subjects factors. Thus, for the conflict network, congruency (congruent vs. incongruent) was the within-subjects factor; for the alerting network, cueing (no cue vs. double cue) was the within-subjects factor; and for the orienting network, cue type (central vs. spatial cue) was the within-subjects factor. For all three analyses, no significant main effects or interactions reached statistical significance.

The SI task. To analyze the SI task, we followed the procedure reported by Siegal et al. (2007). The dependent variable was the number of correct responses in the test trials of the SI task. The number of correct responses was submitted to 2 × 2 mixed ANOVA with scale type (*all–some* and *start–finish*) as a within-subject factor, and language group as a between-subject factor. There was a significant main effect of scale type, $F(1, 56) = 14.96$, $p < .00001$, $\eta^2 = .211$. Children made more correct responses to the *all–some* scale ($M = 3.51$) than to the *start–finish* scale ($M = 2.44$). There was no main effect of language group, nor any interaction involving language group.

Following the procedure of Papafragou and Musolino (2003), children were asked to provide justifications for their negative answers, to ensure that when children gave a correct "no" response in

the SI task, they were actually shifting attention to the opposite scalar term that should have been used (e.g., *all* instead of *some*). These justifications were then separated into two categories: (a) correct ones, invoking the stronger scalar term (e.g., "that *all* of the horses jumped over the fence") and (b) irrelevant ones, where children gave a justification not related to SI for their negative answer (e.g., "that *three* horses jumped over the fence"). The number of correct rejections was then compared across language groups. There were no significant differences between monolingual (M = 1.48) and bilingual (M = 1.30) children.

The language-switching task. As the standard deviations of the mean language-switching RTs were high (M = 1,938 ms, SD = 1,008 for the switch-to-L1 condition; M = 1,527 ms, SD = 726 for the switch-to-L2 condition), a square root transformation was used to normalize the distribution of scores. There was a significant difference between the switch-to-L1 (Albanian, 43 ms) and switch-to-L2 (Greek, 38 ms) conditions, $t(26) = 2.713$, $p = .012$. In other words, there was an overall asymmetrical switch cost. To test for a relation between bilingual skill and cognitive performance, we submitted the SCA scores, the attentional networks scores, and correct responses in SI into a Pearson correlation analysis after applying a square root transformation to the raw data. Bonferroni adjustments for multiple comparisons gave an alpha level of .01 or less. No significant correlations were found.

Discussion

Experiment 2 replicated the major findings of Experiment 1 in a younger sample of children. Monolingual and bilingual participants matched in low SES did not differ in attentional function (neither in attentional control, nor alerting, nor orienting). This finding is consistent with the results reported by Antón et al. (2014) who employed the same version of the ANT child, as well as the results reported by Morton and Harper (2007), Duñabeitia et al. (2014), and Gathercole et al. (2014).

Furthermore, there was no advantage for bilinguals over monolinguals in the SI task, which assesses cognitive flexibility, and pragmatic competence. Although previous studies had reported a bilingual advantage on SIs (Siegal et al., 2007; Slabakova, 2009), these studies did not control for SES. The current findings indicate that when SES is adequately controlled for (in this case by matching the two groups of participants), the bilingual advantage is either attenuated or eliminated entirely. Alternatively, it could be that the lack of significant differences between bilingual and monolingual children in the SI task reflects a positive effect of bilingualism. That is, studies have shown that bilingual children have a smaller vocabulary than monolingual children even when they are assessed in their dominant language (Siegal et al., 2009). As shown in Table 1, this was also the case for the samples of children tested in our study. Since the ability to derive scalar inferences has been linked to lexical maturation (Barner & Bachrach, 2010), one might expect that bilingual children would performance worse than monolingual children in the SI task, particularly when bilingual children are tested in their nondominant language (Greek). Thus, the null difference in this study may actually indicate a bilingual benefit, since bilingual participants performed better than expected (Siegal et al., 2009). We will return to these points in the General Discussion.

Regarding the relations between the attentional networks, we did not replicate the positive association between the alerting and orienting network reported in Experiment 1. There was a slight methodological difference between the two versions of the child ANT used in Experiments 1 and 2. Specifically, the visual cue (an asterisk) in Study 1 was replaced by a tone in the alerting condition in Study 2. This modification was first introduced by Callejas et al. (2004) so that the alerting and orienting networks could be assessed independently. Our findings support this claim by showing an interdependence of these two attention networks.

General Discussion

This article had two main aims: to investigate whether there is a bilingual effect in attentional function, cognitive flexibility, and pragmatic competence once any confound with SES is eliminated, and to investigate the possible relations between the bilingual experience (whether participants are balanced or dominant bilinguals) and cognitive performance. In two different samples of children, and using two different tasks assessing various cognitive processes (attentional function, cognitive flexibility, and pragmatic competence) we failed to obtain a bilingual advantage over monolinguals who were well matched for low SES. However, we did find a correlation between level of bilingualism and ability to resolve conflict within the bilingual group (Experiment 1), suggesting a bilingual effect

in the executive attention network. Additionally, the lack of significant differences between the two language groups in pragmatic competence (SI task in Experiment 2) could potentially be interpreted as a bilingual benefit. That is, as discussed earlier, bilingual children would be expected to perform worse on this task due to their typically reduced vocabulary compared to monolingual children. Thus, the null difference may suggest that a bilingual advantage in conversational understanding may have compensated for the lexical immaturity in bilingual children, and may have facilitated the use of nonlinguistic cognitive abilities to draw scalar inferences equally well with monolinguals (Siegal et al., 2009). This remains for future studies to further investigate.

The overall lack of a bilingual advantage in low-SES bilingual children compared to their low-SES monolingual peers goes against several previous findings that showed a bilingual advantage in other tasks of attentional control, and in drawing SIs and pragmatic competence overall. However, there seem to be now mounting evidence on the failure to replicate the bilingual advantage (Antón et al., 2014; Duñabeitia et al., 2014; Gathercole et al., 2014). Additionally, our findings are consistent with Morton and Harper's (2007) study, which also failed to find any evidence for a bilingual advantage. It is worth noting that Morton and Harper's study has been criticized for having a small number of participants (17 monolingual and 17 bilingual participants; Bialystok, 2009). The present study thus significantly contributes to this debate by including a substantially larger sample of participants (54 bilingual and 56 monolingual participants in total) with a broader age range (from 6 to 12 years). In addition, we failed to replicate the bilingual advantage in two different tasks that have been previously used in bilingual studies (the ANT and the SI task).

It has been already established that SES has a profound effect on attentional function, and particularly on attentional control. For instance, children of low SES tend to show poor self-regulation (Buckner, Mezzacappa, & Beardslee, 2003), which is an index of executive control maturity. Children of middle SES also outperform low-SES peers in measures of executive control (Farah & Noble, 2005; Noble, Norman, & Farah, 2005). In addition, low SES—and specifically the low quality of the home environment—has been shown to directly influence children's inhibitory control and sustained attention (National Institute of Child Health and Human Development Early Child Care Research Network, 2003). More directly relevant to our study, Mezzacappa (2004) found that higher SES children were faster and more efficient in the alerting and conflict trials of the child ANT than lower SES children. Thus, the lack of a systematic measure of SES in previous studies may have led to an overestimation of the bilingual advantage. Results from the present study indicate that the bilingual advantage is greatly attenuated when monolingual and bilingual participants are carefully matched on SES.

One interesting question that remains to be addressed is which aspects of the SES construct may account for the modulation of the bilingualism effect (for reviews, see Bradley & Corwyn, 2002; Hackman & Farah, 2009). Past studies have suggested several characteristics that could have played a role. For example, parent–child interactions, parental education, and income have all been shown to directly influence frontal cortex development (Farah & Noble, 2005; Noble et al., 2005). Low parental education and income (Linver et al., 2002; National Institute of Child Health and Human Development Early Child Care Research Network, 2003), as well as limited parental provision of emotional support and limited cognitive stimulation at home, have also been shown to impair the development of attention (Kochanska et al., 2000; Linver et al., 2002). These questions remain for future studies to investigate.

Another potentially fruitful pathway for future research would be to study the possible effects that the culture of the bilingual participants can have on their cognitive performance. Cultural influences in cognition have been well documented in the past (for a review, see Markus & Kitayama, 1991). For example, it has been demonstrated that Chinese preschool children show superior executive functioning abilities in comparison to children from Western cultures, such as the United States, possibly because Chinese culture values and encourages control of impulsivity, which is a central executive function characteristic (Chen et al., 1998; Ho, 1994; Sabbagh, Xu, Carlson, Moses, & Lee, 2006; Wu, 1996). However, many of the studies that report a bilingual benefit in attention included Canadian Chinese or Cantonese participants in their bilingual group, but only Canadian English participants in their monolingual groups—that is to say, groups that may have differed in significant cultural ways, as well as in terms of their language ability (Bialystok, 2006; Bialystok & Martin, 2004; Bialystok & Senman, 2004). Although our participants are likely to be well matched in this variable, as they all came from collectivist cultures (Northern Greece and

Albania; Eupedia, 2012), the present study was not designed to investigate cultural effects on bilinguals' cognitive performance. This nevertheless remains an important line of inquiry for any comprehensive account of the relations between bilingualism and other cognitive abilities.

Although we did not find a difference in performance between bilingual and monolingual participants, we did find a correlation between how balanced participants were in both languages (as measured by the language-switching task) and the ability of bilingual participants to resolve conflict (Experiment 1). That is, the more balanced the bilingual children were, the faster they resolved conflict in the ANT task, suggesting that the potential cognitive effects of bilingualism are unlikely to be all or nothing, but instead may be proportionate to the degree of balanced bilingualism. This supports the hypothesis that bilingualism is similar to other types of training (e.g., videogame training), and that the more experienced one is in bilingualism, the greater the benefit on cognitive performance (Bialystok, 2009).

The findings from Experiment 1 with regard to balanced bilinguals also suggest that effects of bilingualism are not completely eliminated when SES is controlled for. Furthermore, it offers grounds for thinking that the locus of the bilingual cognitive influence is likely to be highly specific and lies in executive attention and no other attentional function. We note that this finding was not replicated in Experiment 2. However, we believe that this difference should be attributed to the age difference between the samples. Children in our second experiment were younger than those in our first experiment, and would thus have been exposed to L2 for fewer years. This is likely to mean these children were less well trained in switching between languages. Consistent with this hypothesis, we found that children in Experiment 2 had a significantly greater SCA and showed greater variability in their ability to switch between languages (M = 636 ms, SD = 750.29) than children in Experiment 1 (M = 306 ms, SD = 389.6), $t(52) = 2.005$, $p = .05$. The present study is not able to disentangle the bilingual experience in terms of years of being bilingual (studied across life span), and the amount of exposure to both languages on an everyday basis. However, the current findings indicate that further research in this area is likely to be valuable and informative.

In conclusion, the present study suggests that nonlinguistic, sociocultural factors may attenuate bilingualism's effects on children's cognitive performance. We consider it vital for future studies to elucidate the question of which specific SES variables may modulate the bilingual effect in attention and cognition overall. A further issue raised by the present results is that of bilingual experience and its effects on behavior. It has been shown in Experiment 1 that the amount of training in language switching is directly related to resolving conflicting information of a nonlinguistic nature. It remains for future studies to fully determine the nature of this association.

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Appendix: *Self-Reported Measure on Socioecomic Status Employed in This Study*

Questionnaire on Demographic Information, Socioeconomic Status and Language Background

The information you are going to give in this questionnaire is going to be strictly used for the purposes of the present research. All information will be kept strictly confidential and only the researcher and her two supervisors will have access to it.

- FIRST & LAST NAME: .....

  .....

- relation to the child who is going to participate in the study: (please circle)

  PARENT GUARDIAN

Section 1: To be completed by the parent/ guardian of the child who is going to participate in the study.

A. Demographic information of the child who is going to participate in the study:

Date of birth: .....

Grade in primary school he/she is attending right now: .....

Gender (please circle): boy girl

Nationality (please circle):

Albanian Greek both Greek & Albanian other (please specify).....

Language the child speaks (please circle):

Albanian Greek both Greek & Albanian other (please specify).....

B.1 Socioeconomic status (of the mother of the child who is going to participate in the study)

1. What is your formal education (please circle):

a) I did not finish primary school.

b) I graduated from primary school.

c) I graduated from intermediate school (between primary & high school).

d) I graduated from high school.

e) I graduated from a technical college (TEI).

f) I graduated from a school of higher education (private or public university).

2. Are you currently employed (please circle)? YES NO

3. If yes, what exactly is your occupation?

.....

.....

4. What is your exact post in this job (please circle all that apply)?

a) employer (I occupy personnel)

b) I run my own business

c) higher executive or managerial personnel, in the public or private sector

d) employee

e) skilled (e.g. worker, salesperson etc.)

f) unskilled (e.g. worker, salesperson etc.)

B.2 Socioeconomic status (of the father of the child who is going to participate in the study)

1. What is your formal education (please circle):

a) I did not finish primary school.

b) I graduated from primary school.

c) I graduated from intermediate school (between primary & high school).

d) I graduated from high school.

e) I graduated from a technical college (TEI).

f) I graduated from a school of higher education (private or public university).

2. Are you currently employed (please circle)? YES NO

3. If yes, what exactly is your occupation?

.....

.....

4. What is your exact post in this job (please circle all that apply)?

a) employer (I occupy personnel)

b) I run my own business

c) higher executive or managerial personnel, in the public or private sector

d) employee

e) skilled (e.g. worker, salesperson etc.)

f) unskilled (e.g. worker, salesperson etc.)

C. Language background and language history of the child who is going to participate in the study.

1. In which country was the child born?

Albania ☐ Greece ☐ Other ☐ (please specify) _____

2. In which country has the child spent most of his/her life?

Albania ☐ Greece ☐ Other ☐ (please specify) _____

3. For how many years has the child leaved in Greece? _____ years

4. For the time that the child has been living in Greece, has he/she travelled to another country/tries? YES NO

5. If yes, in which country/ies has he/she travelled and for how long has he/she stayed there?

a) ……..country, for ……months

b) ……..country, for ……months

c) ……..country, for ……months

d) ……..country, for ……months

6. Does the child do any extracurricular activity related to language (e.g. private language school/ private language lessons at home/ other kind of language-related activity)? YES NO

7. If yes which are those activities, for how many hours per week and for what language? (please complete the table appropriately)

activity	hours per week	in what language
1.		
2.		
3.		
4.		

End of Section 1.

The next Section (Section 2) is to be completed by the child who is going to participate in the study, with the aid of the parent/s.

Section 2: To be completed by the child who is going to participate in the study, with the aid of the parent/ guardian.

1. **Do you use any language other than Greek at your house?** YES NO
2. **If yes, what is that language?** .....
3. **If yes, how often do you use that language at your house?** (please tick the appropriate box)

Always ☐ Most of the time ☐ Not much ☐ Rarely ☐

4. If you use a language <u>other</u> than Greek, how well do you:

- <u>Speak in that language?</u>

Very well ☐ Well ☐ Not well ☐ Not at all ☐

- <u>Read in that language?</u>

Very well ☐ Well ☐ Not well ☐ Not at all ☐

- <u>Understand that language?</u>

Very well ☐ Well ☐ Not well ☐ Not at all ☐

- <u>Write in that language?</u>

Very well ☐ Well ☐ Not well ☐ Not at all ☐

5. Before you started going to school, you spoke:

Albanian ☐ Greek ☐ Other (please specify) ☐ _____

6. Are you being taught a language at school <u>other</u> than Greek? YES NO

7. If yes, what is that language? .....

8. For how long have you been taught that language at school?

Less than a year ☐ More than 1 year ☐ More than 3 years ☐

9. How well do you:

- <u>Speak Greek?</u>

Very well ☐ Well ☐ Not well ☐ Not at all ☐

- <u>Read in Greek?</u>

Very well ☐ Well ☐ Not well ☐ Not at all ☐

- <u>Understand Greek?</u>

Very well ☐ Well ☐ Not well ☐ Not at all ☐

- <u>Write in Greek?</u>

Very well ☐ Well ☐ Not well ☐ Not at all ☐

10. What language do you use with your parents? .....

11. What language do you use with your siblings (if you have any)?.....

12. What language do you use with your friends? .....

13. What language do you use with your relatives (e.g. grandmother, grandfather, aunt/s, uncle/s, cousin/s)? .....

14. What language do you use with your classmates and teachers? .....

End of questionnaire. Thank you for your participation.

(Please return the questionnaire to the teacher of the child.)