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Laketa, A., Studenica, A., Chrysochoou, E. et al. (2 more authors) (2021) Biculturalism, linguistic distance, and bilingual profile effects on the bilingual influence on cognition: A comprehensive multipopulation approach. Journal of Experimental Psychology: General. ISSN 0096-3445

https://doi.org/10.1037/xge0000794

Biculturalism, Linguistic Distance, and Bilingual Profile Effects on the Bilingual Influence on Cognition: A Comprehensive Multi-population Approach

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Abstract

The idea that being bilingual benefits one's cognitive development and performance has been greatly challenged over the last years. If such an effect exists, as some studies continue to show, it might actually be restricted to particular contexts and bilingual profiles; not unlikely, considering the enormous diversity in the latter across the world. In this study, we assessed four different bilingual populations (N = 201) and two monolingual populations (N = 105), in the Balkan region. We formed bilingual groups based on (a) acculturation strategy (Bicultural vs Monocultural), (b) linguistic distance, as well as (c) bilingual profile (*balanced vs unbalanced)*, based on linguistic, affective, and acculturation measures and cluster analysis. Beyond prior work, this allowed us to explore the specific conditions under which any cognitive advantage may be observed in bilinguals. We did not find systematic evidence for positive effects of bilingualism, biculturalism, or a balanced bilingual profile on inhibitory control, cognitive flexibility, monitoring, and proactive-reactive control management. The only evidence pointing to an advantage was restricted to Bosnian-Albanian bilinguals (linguistic distance analyses) and their conflict monitoring and general monitoring capacities. Acculturation strategy though, played an important role in shaping the bilinguals' language profile, and appeared to have independent effects on cognition from bilingualism. On this basis, acculturation should be considered in future explorations of bilingual cognitive development.

Keywords: cognitive performance; bilingualism; acculturation; motivation; linguistic distance

Biculturalism, Linguistic Distance, and Bilingual Profile Effects on the Bilingual Influence on Cognition: A Comprehensive Multi-population Approach

Whether bilingual experience exerts effects on cognitive development and performance, as a result of the training and neuroplasticity associated with this experience, has become greatly disputed in the last decade. This is reflected in the increasing amount of reviews and meta-analytic studies that have been published over the last 10 years, in an attempt to settle this debate (Adesope et al., 2010; de Bruin et al., 2015; Donnelly, 2016; Donnelly et al., 2019; Grant et al., 2014; Grundy & Timmer, 2017; Hilchey & Klein, 2011; Hilchey et al., 2015; Lehtonen et al., 2018; Van den Noort et al., 2019; Paap et al., 2015; Samuel et al., 2018; Tabori et al., 2018; Zhou & Krott, 2016). Nonetheless, scientific opinion continues to be divided, with some meta-analyses and reviews supporting an overall positive effect of bilingualism on cognitive performance (e.g., Adesope et al., 2010; de Bruin et al., 2015; Grant et al., 2014; Grundy & Timmer, 2017; Hilchey & Klein, 2011; Van den Noort et al., 2019), while other meta-analyses and reviews suggest that the effect does not exist or might be restricted to specific contexts of bilingual development and language use (e.g., Donnelly, 2016; Donnelly et al., 2019; Hilchey et al., 2015; Lehtonen et al., 2018; Paap et al., 2015; Paap, 2019; Samuel et al., 2018). One reason why there may be such mixed findings is that bilingualism effects may be confounded by other factors, relatively overlooked so far, such as the type of languages spoken, affective factors related to language learning, cultural background or acculturation processes (namely the social, psychological, and cultural changes that occur as a result of the conjunction of two or more cultures; Ashmore et al., 2004; Phinney, 2003; Phinney et al., 2001).

The main idea behind this so-called *bilingual cognitive advantage* is that any training effect of managing two co-activated language systems may transfer to executive control

(Blumenfeld & Marian, 2013). Authors differ though regarding what is the specific locus of this advantage. For instance, it has been proposed that the management of co-activation involves supressing interference from the non-target language, while using the target language (e.g., Lemhofer et al., 2004; Starreveld et al., 2014); and successfully recognizing and producing language switches, when changing from one language to the other (e.g., Abutalebi & Green, 2008; Thomas & Allport, 2000). This *inhibitory control hypothesis* for the bilingual cognitive advantage (e.g., Abutalebi et al., 2015; Sorge et al., 2017; Yang et al., 2011) derives from the *inhibitory control model* proposed by Green (1998) regarding mental control of the bilingual lexico-semantic system. It has also been suggested that bilinguals have an advantage in *cognitive flexibility*, namely the ability to quickly adjust and adapt to a current, goal-relevant task (Miyake & Friedman, 2012). For bilinguals, this would be a result of demands to continuously decide when and how to switch back-and-forth between languages (i.e. task-switching demands; Prior & MacWhinney, 2010). Moreover, Costa el. (2009) suggested that bilinguals need to continuously monitor the surrounding context, in order to recognize and use the appropriate (target) language, depending on a given situation (e.g., the environment, the interlocutor, etc.). According to this hypothesis, bilinguals would therefore, have an advantage in *general or attentional monitoring* (Costa et al., 2009; Hilchey & Klein, 2011; Woumans et al., 2015). Finally, Morales and colleagues (2013, 2015) adopted the *dual mechanisms of cognitive control* approach to the bilingual advantage (Braver, 2012); proposing that bilinguals are better at adjusting their relative use of proactive control (monitoring) and reactive control (inhibition), in order to achieve efficient performance.

Although, there seems to be a shift in publication trend, with studies showing mixed findings or null effects being more common since 2012 (see van den Noort et al., 2019 meta-analysis study), the debate is ongoing. Over the last 5 years, a number of studies have reported positive effects of bilingualism on cognitive performance, even when controlling for possible confounds. Specifically, positive effects have been reported for shifting (Qu et al. , 2016; Stasenko et al., 2017), conflict monitoring (as indexed by smaller mixing costs; Chrysochoou et al., in press; Wiseheart et al., 2016), cognitive control strategies (Gullifer et al., 2018; Hansen et al., 2016 with children; Morales et al., 2015), and inhibitory or/and executive control (Anderson et al.,2018 with adolescents; Incera and McLenna 2018, and Subramaniapillai et al. 2018 with older adults; see also Woumans et al., 2016, for longitudinal evidence). Positive effects on cognitive performance have additionally been reported in three recent meta-analysis (Anderson et al., 2020; Grundy & Timmer, 2017; de Bruin et al., 2015). Thus, it seems safe to conclude that the bilingual cognitive effect may arise under specific conditions. For instance, Lehtonen et al. (2018; see also Donelly 2016 and van den Noort et al., 2019) found that country moderated the outcome of the analyses regarding certain cognitive measures. In line, it has been suggested (see Bak, 2016; Gathercole et al., 2014) that inconsistencies in findings may be related to variation in bilinguals' socio-linguistic context among studies. Indeed, no two bilingual populations are the same, differing among other factors in bilingualism onset and language development, language learning and use in context, migrant status, as well as degree of integration in the host society (see also de Bruin's, 2019 call for more detailed descriptions of bilingual experiences). However, there is little work investigating these factors from a comprehensive approach.

In the present study, we aimed to comprehensively examine the bilingual advantage as a function of the under-researched acculturation factor, the linguistic similarity between the languages spoken by bilinguals (also considered in very few studies so far), language development and use indices (e.g. bilingualism onset, language proficiency, frequency of use), as well as affective reactions toward groups, individuals and concepts associated with learning a language other than the native tongue (motivation/ attitudes factors). However, it may be that such factors do not have an effect in isolation, but instead they interact in a combined or additive fashion, forming particular bilingual *profiles* that positively affect cognitive development and performance. To investigate this possibility, we conducted cluster analyses within the bilinguals' sample, involving seven variables reflecting language development and use (i.e. bilingualism onset, relative proficiency, frequency of language use), bilingual language switching, affective reactions (motivation and attitudes) towards language learning and use, and acculturation. To our knowledge such a methodological approach has only been used in two relevant studies, which, however, focused on linguistic variables only (Hindle et al., 2015; von Bastian et al., 2016). We believe that the present study is a significant step in understanding which bilingual experiences might foster positive effects on cognition, if any (Lehtonen et al., 2018).

For instance, the acculturation strategy adopted by bilingual participants may influence their cognitive performance indirectly or directly. Heritage language maintenance and host language acquisition do not occur in a social vacuum; immigrants' level/type of acculturation can affect language learning outcomes (linguistic and affective). Specifically, integration/biculturalism has been regarded the optimal acculturation strategy for successful development, as well as long-term maintenance of both the heritage and host languages, that is, forming a "balanced" bilingual profile (e.g., Cummins, 2012; Gatbonton & Trofimovich, 2008; Lai et al., 2015; Lee, 2001; Vanalainen, 2010). Consequently, bicultural bilinguals (those integrated and identifying with both cultures), who typically have greater proficiency and use both languages more in daily life (Pavlenko, 2011), should in turn face greater demands in language management, and according to the hypotheses outlined above, also show greater benefits in cognitive performance.

Acculturation has also been suggested to have an independent and direct effect on cognitive control. According to the *acculturation complexity model* (Tadmor & Tetlock, 2006), bicultural individuals are better able to recognize, accept and integrate potentially competing views (e.g., norms, ideals, values; Suedfeld & Bluck, 1993; Tadmor & Tetlock, 2006). Consequently they are more likely to engage in cultural frame switching; namely, switching from one cultural mind-set to another, and selecting the target frame, depending on the surrounding environment (Benet-Martínez et al., 2002; Hong et al., 2000; Spiegler & Leyendecker, 2017). Similarly to the concept of language management in bilingualism, managing two cultural mind-sets may engage, and thus enhance, cognitive control mechanisms (Tadmor et al., 2009), including inhibitory control, monitoring, and shifting (Spiegler & Leyendecker, 2017; Xie, 2019).

To sum up, the processes involved in cultural frame switching seem to closely mimic those involved in bilingual language control, which suggests that some of the observed bilingualism effects on cognition might have actually resulted from acculturation effects. Indeed, there is even some evidence in support of this view. For instance, Xie (2019) found that bilinguals that were frequent cultural switchers had better inhibitory control (as indexed by Simon and Flanker effects), and set-shifting ability, relative to infrequently switching peers. Also, Spiegler and Leyendecker (2017) found that among 225 Turkish-German immigrant bilingual children, those more equally endorsing Turkish and German cultures, had better shifting ability (in a dot task) relative to peers endorsing either of two cultures.

In the present study, bilinguals' type of acculturation in the host society was investigated in the context of the *bidimensional acculturation model* (Berry,1997, 2003), which is the most widely accepted in the relevant literature (Meca et al., 2017). Overall, bi-dimensional models of acculturation have received more support, being regarded as more appropriate to capture the complexity of acculturation outcomes of diverse groups (e.g, migrants, ethnic minorities etc) and allow for biculturalism to be identified, relative to uni-dimensional models (e.g., Costigan & Su, 2004; Portes & Rumbaut, 2001; Schwartz et al., 2007). Specifically, Berry's model proposes that an acculturation strategy can be characterised through two main processes; cultural maintenance, and contact and participation. On that basis, four distinct acculturation strategies can be derived. An *assimilation strategy* refers to rejecting one's own ethnic identity and background, while fully adopting the host societies' culture, and seeking daily contact with its members. An *integration strategy* regards retention of one's own ethnic identity and background, combined with openness towards the host culture and the members of the host society. A *separation* strategy is characterized by strong ethnic (L1) identification, combined with unwillingness to adopt the host culture and interact with members of the host society. Lastly, a *marginalisation* strategy refers to detachment from both one's own ethnic identity and the host society (Berry, 2003, 2005). That is, integrated bilinguals have a predominantly bicultural orientation, relative to bilinguals adopting a non-integrative strategy (namely, those separated, assimilated or marginalized), who can be considered monocultural.

It has been further proposed that the relationship between acculturation and host language acquisition and proficiency in bilinguals is bidirectional (Jiang et al., 2009; Lybeck, 2002; Schumann, 1986; Waniek-Klimczak, 2011; Ward et al., 2001; Ward & Kennedy, 1999). For example, Cummins (2012) strongly argues that maintaining L1 (heritage language) literacy and ethnic identity, combined with an openness and willingness to identify with the L2 (host) culture (i.e. having a *bicultural orientation*) provides immigrants with valuable social capital and resources that can be utilized in the development of L1-L2 literacy skills. Furthermore, in the *Socio-Educational Model* suggested by Gardner (2001, 2007), one's openness and willingness to identify with the L2 culture, referred to as *integrativeness*, is assumed to play a central role in L2 learning motivation, thus, having a positive effect on a variety of L2 learning behaviours and outcomes. Indeed, such affective variables, including integrativeness, attitudes toward the L2 group and motivation to learn a language other than one's heritage – native tongue, constitute an essential part of the cultural learning process and one's successful adaptation in a host society (Masgoret & Ward, 2006). Within this framework, the present study employed a measure of bilinguals' motivation and attitudes towards learning a language other than the native tongue, aiming for a comprehensive examination of bilingual profiles in the cluster analyses conducted, along with measures of acculturation, and language development and use.

Another factor that might relate to bilingual cognitive development, but has received little attention so far, regards the differences between the languages a person speaks (*linguistic distance* in the present study). For instance, if management of co-activation involves a domain-general attentional control capacity, then the bilingual advantage should be predominantly observed in bilinguals who speak similar languages, and are thus expected to experience greater cross-linguistic interference (Oschwald et al., 2018). Yet, the few studies conducted so far were inconclusive, showing either null or positive effects, which however pointed to the opposite direction. For example, Barac and Bialystok (2012) tested English monolinguals and Chinese-English, French-English, and Spanish-English bilinguals and found that the degree of similarity between languages or culture did not modulate the bilingual advantage observed in cognitive flexibility. They described language similarities qualitatively, relying on typical levels of linguistic analysis (i.e. phonology, grammar, and morphology), type of writing system, as well as language families (in genealogical classifications). Similarly, Linck and colleagues (2008) did not find a significant overall effect of script similarity on inhibitory control (Simon task), involving groups of bilinguals who spoke languages having dissimilar (Japanese-English) versus similar scripts (Spanish-English). However, the specific linguistic distance index interacted with the variables of country and cultural context that bilinguals lived in (L1 vs L2). That is, a group difference emerged for L2 context (USA), but not for L1 (Japan/ Spain, respectively), with bilinguals speaking more distant languages performing better on inhibitory control.

Oschwald and colleagues (2018) examined the effect of language similarity (based on language families in genealogical classifications) on the bilingual cognitive advantage. Participants were young adult German monolinguals, German-Swiss German bilinguals (bidialectal bilinguals – highest similarity), German-English bilinguals (same language family), and German-Turkish bilinguals (different language families). The authors did not replicate the bilingual advantage on inhibitory control and cognitive flexibility. However, in line with the co-activation hypothesis, bidialectals outperformed monolinguals in a working memory task. A previous study had instead reported an effect pointing to the opposite direction. In contrast to the co-activation hypothesis, Coderre and van Heuven (2014) found that the group with more distant (in terms of script this time) language pair (Arabic-English) showed an advantage in inhibitory control (with the Stroop, but not the Simon task) relative to German-English and Polish-English bilinguals and the monolingual group. Although Arabic-English bilinguals had overall higher response times than the other bilingual groups. It is noted that the bilingual advantage on inhibitory control may be difficult to interpret, since researchers used a word Stroop task which confounds the effect of language. So, although similarity of the languages has been studied somehow in relation to the bilingual cognitive advantage, findings remain inconclusive; whereas a general conclusion is further limited by the different approaches adopted to define linguistic distance.

Going beyond prior work, the present study aims at examining under which specific conditions a bilingual cognitive advantage may be demonstrated. In doing so, we investigated the bilingual cognitive advantage as a function of acculturation/biculturalism and linguistic distance. However, also considering other language learning and development factors, that might determine the bilingual *profile*, such as bilingualism onset, relative language development (proficiency) and use (frequency of use, bilingual language switching), as well as bilinguals' affective reactions to learning a language other than their native tongue (motivation and attitudes). In order to have enough variation in the above factors so as to form relevant groups, we assessed four different bilingual populations ($N = 201$) and two monolingual populations ($N = 105$) from the same general Balkan region (Serbia, Kosovo, and Greece). In addition, we included three tasks measuring different cognitive (executive) functions, namely inhibitory control (resistance to interference, Simon task), cognitive flexibility and conflict monitoring (colour-shape switching task), and cognitive control strategies (AX-CPT task), to address the issue of task-specific vs. ability-general effects (Miyake & Friedman, 2012).

Specifically, the Simon task was chosen because it imposes similar cognitive demands to the ones faced by bilinguals when having to select the target language in the face of co-activation of the context-irrelevant language. That is, it requires selection of a task-relevant response (colour) in the face of conflictive (irrelevant) automatic activation (the stimulus location). Although there is currently some disagreement in the literature about the exact nature of the selection mechanisms underlying performance in these tasks (e.g., Paap et al., 2019; Rey-Mermet et al., 2018), such examination is beyond the scope of the present study. Consequently, we have opted to refer to the Simon task as an index of inhibitory control as it has been supported by many authors (e.g.,Van der Lubbe, & Verleger, 2002)**.** We additionally employed the colour-shape switching task developed by Prior and MacWhinney (2010), because it allows for the assessment of both switching and mixing costs. Switching cost reflects the processes involved in reactivating the correct sorting rule, and reconfiguring stimulus-response mappings; thus, it reflects shifting abilities and cognitive flexibility. Whereas mixing cost reflects the ability to monitor and maintain two competing response sets. Another task, the AX-CPT, has been used in a small number of relevant studies; most of them have reported positive effects of biligualism, yet not always including a monolingual group (Bonfieni et al., 2020; Beatty-Martínez et al., 2019; Gullifer et al., 2018; Zhang et al., 2015). This task is different in the sense that it does not only assess cognitive control per se, but also measures the ability to strategically coordinate proactive and reactive control to optimize performance. Thus, it allowed us to test the hypothesis that bilingual participants are better in recruiting and coordinating different cognitive control strategies (the *dual mechanisms of cognitive control hypothesis)*.

Thus, we classified bilingual participants into bicultural or monocultural, and compared them to the groups of monolinguals, to investigate the effect of acculturation strategy. In addition, we compared the bilingual groups formed on the basis of linguistic distance, with monolingual participants. We classified language pairs within a *comparative (historical)* linguistics framework. That is, we relied on genealogical classifications of the languages spoken by participants, identifying their *language families* and thus, the degree of their *diachronic relatedness* (Körtvélyessy, 2017). Bosnian, Albanian, and Greek are all Indo-European languages, whereas Turkish belongs to a different family (Turkic; see Table 1). However, addressing criticism regarding genealogical classifications as a sole language comparison criterion (see Georgi et al., 2010), we also analysed languages on typological, linguistic grounds (Bubenik, 2011), according to their common structural features at the morphological and syntactic levels (Booij, 2012; Easterday, 2017; Körtvélyessy, 2017; Sandler & LilloMartin, 2006; Song, 2014; Van der Hulst, 2014; Velupillai, 2012). Differences at these grammatical levels can result in significant, long-lasting effects on language representation and processing (see Sabourin & Stowe, 2008; Tokowicz & MacWhinney, 2005). On that basis, again Bosnian and Greek share main qualities with Albanian and they all differ from Turkish (see Table 1). Thus, one can safely conclude that Turkish-Albanian bilinguals speak more distant languages, relative to Albanian-Greek and Bosnian-Greek bilinguals.

Taking a step further, we conducted cluster analyses and divided the full bilingual sample (N = 201) according to their profile (*balanced* vs *unbalanced*). To do so, we relied on bilingualism onset, language development (relative proficiency) as well as use (frequency ratios, language switching), affective reactions towards language learning (motivation and attitudes), and acculturation. To our knowledge, such a comprehensive account of the bilingual profile has not been attempted so far. The bilingual profile groups were then compared to each other and to monolinguals in terms of cognitive performance.

We tested the following hypotheses. Given that an integrative strategy/bicultural orientation results in a more balanced bilingual profile (*via* its influences on language learning and use within the sociocultural setting), and seems to influence positively cognitive performance independently from bilingualism, we expect that bicultural bilinguals should show better resistance to interference, cognitive flexibility, monitoring and proactive-reactive control management, relative to monocultural bilinguals and monolinguals.

With regard to the effect of linguistic distance on cognitive performance, previous findings are inconclusive and rely on very different linguistic distance measures. We thus based our predictions on the cross-linguistic interference hypothesis related to the bilingual cognitive advantage (Bartolotti & Marian, 2012; Bialystok, 2007; Costa et al., 2008). That is, the more similar the languages spoken, the more cross-linguistic interference, and thus the greater the demands imposed on executive control to select the appropriate language and resist interference from the other. Some authors have proposed that the demands set may expand to switching between the languages and monitoring as well (Barac & Bialystok, 2012; Coderre & van Heuven, 2014; Linck et al., 2008). Thus, we hypothesize that the Bosnian-Albanian and the Greek-Albanian bilinguals would not differ from each other, but would outperform monolinguals and Turkish-Albanian bilinguals (the bilingual group with the more distant languages) in inhibitory control, cognitive flexibility, and conflict monitoring.

Finally, if the bilingual cognitive advantage emerges only when language development and use, affective reactions (motivation and attitudes) toward second language learning and use, as well as acculturation-related factors interact within the bilingual individual, we hypothesized that bilinguals participants with a balanced bilingual profile (higher scores on the motivation and attitudes associated with learning and using a language other than the native tongue, lower ethnic identity and higher other-group orientation, more balanced language proficiency and frequency of language use, and earlier bilingualism onset) would show better cognitive performance (resistance to interference, cognitive flexibility and monitoring, and proactive-reactive control management) than the unbalanced bilingual profile group, and the monolingual group.

Method

Participants

Two-hundred and one bilingual adults (95 male, 106 female), and 105 monolingual peers (51 male, 54 female) participated in the present study. Bilinguals were recruited from three different geographical locations (Serbia, Kosovo, and Greece) in the Balkan region, and spoke different language pairs (Albanian-Serbian/Bosnian-Albanian[1], Turkish-Albanian, and Albanian-Greek).

Three of the bilingual populations (Albanian-Serbian, $N = 51$; Bosnian-Albanian, $N = 50$; Turkish-Albanian, $N = 50$) were non-immigrant members of ethnic communities (1.1 to 6% of the total population; Central Intelligence Agency, 2016; Statistical Office of the Republic of Serbia, 2003) living in the respective host country due to historical events. Specifically, the Turkish-Albanian bilinguals in Kosovo (approx. 250,000 people; Organization for Security and Co-operation, 2010), are of mostly Turkish, as well as of Albanian origin. Those of Turkish origin came to the area during the Ottoman Empire years, and since then, have enjoyed privileged status in the society. The Turkish language is still highly considered, with a large population of Kosovars (Albanian in origin) as well speaking and/or understanding it. Bosnian-Albanian bilinguals (of Bosnian origin) were recruited from Peja and Prishtina, two cities in Kosovo where this population is mostly concentrated. Similar to Turkish-Albanian participants, the Bosnian-Albanian communities are well adjusted and living in harmony with the Albanian population of Kosovo. Albanian-Serbian bilinguals were also recruited from two cities of Serbia where this population is mostly concentrated; specifically, from Bujanovac and Medvedja

[1] Bosnian language is officially regarded as a national variant of the Serbo-Croatian language (Board for Standardization of the Serbian Language, 2015)

(located in the South of Serbia). Historically, this region had been largely populated by Albanians, but remained part of the Serbian state after World War II (Zylfiu et al., 2017). It is noted that the aforementioned bilingual groups, could have opted to attend monolingual (state school) or bilingual education programmes, or switch between the two, depending on availability of elementary and high-school programmes. In Bujanovac (Serbia) specifically, the Albanian-Serbian population also has access to bilingual higher education courses (Zylfiu et al., 2017; European Commission, 2019), whereas the Turkish-Albanian and Bosnian-Albanian populations in Kosovo can opt for higher education in either Albanian or Turkish/ Bosnian.

On the other hand, the Albanian-Greek (*N* = 50) sample consisted of first- and second-generation economic immigrants (migrating after the fall of communism in Albania in the '90s; Barjaba, 2000; Lazaridis & Wickens, 1999), living in Thessaloniki, Greece. They constitute the largest bilingual community in Greece (56% of the total immigrant population). First generation immigrants had received formal education in Albania before migrating, and some of them also received formal education in Greek after migration. Second generation immigrants have attended the Greek state school, with some of them also having access to Albanian classes, offered by their community during weekends (Center for Democracy and Reconciliation in Southeast Europe, 2017). Bilinguals were recruited in community and cultural centres, universities, as well as via snowball sampling.

The monolinguals of our sample were either Albanian or Serbian speaking, living in Kosovo (*N* = 54) and Serbia (*N* = 51), respectively. They have never actively used any other language in daily life. There was a great effort to match the bilingual and monolingual populations on SES, intelligence, age, and gender, on a strict one-to-one basis; and there were a few exceptions of significant differences (e.g. between Albanian monolinguals and Albanian-

Serbian monolinguals in intelligence, see Table 2). These differences were, however, appropriately controlled for in the analyses.

The study was approved by the University of Sheffield Ethics Committee, and was therefore performed in accordance with the ethical standards laid down in the 1964 Declaration of Helsinki and its later amendments. Informed written consent was obtained from all the participants.

-Insert Table 2 about here-

Materials and Procedure

Demographics and language background. Demographic information (age, SES) and language background (questions regarding language acquisition, experience, proficiency, and language use patterns; see statistics in Table 2) were assessed via a self-report questionnaire that was adapted from previous studies conducted (Costa et al., 2008; Garratt & Kelly, 2008; Ladas et al., 2015; Vivas et al., 2017; 2020). SES was calculated by adding up one's scores on educational level, occupation, and exact profession type and position. Participants were then allocated to low SES (score of 2 to 8), middle status (9 to12), and high SES (13 or greater) groups. Finally, the *Bilingual Switching Questionnaire* (*BSWQ*; Rodriguez-Fornells et al., 2012) was used to measure language switching (frequency, contextual, and unconscious switching). Reliability of the total scale score (12 items) was satisfactory ($\alpha = .69$).

Vocabulary and general intelligence. Productive vocabulary was measured with the *word definitions* subtest of the Wechsler Adult Intelligence Scale (WAIS-III*;* Wechsler, 1997), administered in Albanian, Greek, Serbian, and Turkish, depending on the language/s spoken by each participant (see Ladas, 2013; Ladas et al., 2015; Vivas et al., 2017). The *Ravens Progressive Matrices* (Raven, 1960) was also used to control for general intelligence.

Attitudes and motivation regarding second language learning. An adapted version of the *Attitude/Motivation Test Battery* (*AMTB*; Gardner, 1985) was used to measure bilingual participants' affective reactions toward groups, individuals, and concepts associated with learning a language other than the native tongue. The AMTB is a widely used, valid, and reliable relevant measure (see Atay & Kurt, 2010). Participants' total score was the sum of responses to 52 questions (6-point scale; strongly disagree- strongly agree) reflecting integrativeness, attitude toward learning situation, motivation, language anxiety, instrumental orientation, and parental encouragement. The internal consistency in this study was high, $\alpha = .95$.

Acculturation strategy. The revised versions of the *Multigroup Ethnic Identity Measure* (MEIM-R; Phinney & Ong, 2007) and the *Other-group Orientation scale* (OGO; LaFromboise, Coleman, & Gerton, 1993; Phinney, 1992) were used to identify the acculturation strategy adopted. The MEIM-R measures one's subjective sense of membership to any given cultural group; in the current study, it was applied to the heritage (ethnic) culture of bilinguals. The MEIM-R consisted of six items, scored on a four-point Likert scale ranging from strongly disagree to strongly agree (e.g., I have a strong sense of belonging to my own ethnic group" and "I feel a strong attachment to my own ethnic group"). The OGO scale, which was developed with the original MEIM, measures one's attitude toward and willingness to interact with other cultural groups. The OGO scale consisted of six items, also scored on a four-point Likert scale (e.g., "I like meeting and getting to know people from ethnic groups other than my own" and "I don't try to become friends with people from other ethnic groups"). Participants are divided into four (typical) strategy groups, based on their mean scores on the two measures (for more information, see Lauglo, 2017). Specifically, participants who score above 3 (high) and those who score below 3 (low) in both scales are assigned an *integration* and a *marginalization* strategy, respectively. Those who score high on the MEIM-R, but low on the OGO, are assumed to have adopted a *separation* strategy, whereas those with low and high scores on the scales, respectively, are assigned an *assimilation* strategy. A monocultural group was then formed merging the bilingual groups with non-integration strategies; that is, separation and assimilation strategies (no bilingual participant was assigned a marginalization strategy). When forming a bicultural group, we applied a stricter cut off score of 3.67, instead of 3, on both acculturation measures. This was done in order to obtain a truly representative group of highly integrated bilinguals, which was also comparable in size to the monocultural group (see supplementary Table 1 for demographics, intelligence and language background characteristics per group). Internal consistency was high for both the MEIM-R (α = .83) and the OGO scale (α = .76).

Computerised cognitive measures. All tasks were programmed and administered in E-Prime 2.0 software (Psychological Software Tools, Pittsburgh, PA), and presented on a 15-inch laptop screen.

Inhibitory control was measured with the *Simon* task (e.g. Simon & Rudell, 1967; Bialystok et al., 2004). On a given trial, the target stimulus (a brown or blue circle) was presented for 2000 ms or until response. In the neutral block, the target stimulus appeared above or below fixation point, whereas in the conflict block, the stimulus appeared to the left or right side of the fixation point. Participants were instructed to press a left response key (A) when they saw a blue circle, and a right response key (L) when they saw a brown circle. The task followed a “sandwich” design, neutral block-conflict-neutral. In total there were 96 experimental trials, 48 per condition (Neutral, Congruent, Incongruent), and 16 practice trials.

Cognitive control strategies (proactive versus reactive) were measured with the *AX-CPT* (Morales et al., 2013; Ophir et al., 2009). The task consists of a series of target probe letters (X or Y, where Y represents any letter other than X) that are preceded by a central cue for 300 ms (A or B, where B represents any letter other than A), all in red font. Participants were instructed to respond "Yes" by pressing the "Z" key, when the AX cue-probe pair is presented; and "No" by pressing the "M" key, when the other cue-probe combinations are presented (AY, BX, BY). This key-response mapping was counterbalanced across participants. During the cue-probe interval, three distractor letters were presented in white font for 300 ms each. Participants were instructed to respond "no". The task consisted of a practice block (10 trials), followed by an experimental block (100 trials). In 70% of the trials, the combination AX was presented, whereas in the remaining trials, the other three cue-probe combinations (BX, AY, BY) were presented. The conditions AY and BX are assumed to reflect proactive and reactive inhibitory control, respectively. The difference score (BX-AY) is reflective of the strategy a participant adopted in the task. Specifically, a smaller difference score is reflective of a more balanced reliance on proactive monitoring and reactive inhibition. A higher, positive difference is indicative of more reliance on proactive monitoring, rather than reactive inhibition (a *Proactive strategy)*. Finally, a higher, negative difference is indicative of more reliance on reactive inhibition, rather than proactive monitoring (a *Reactive strategy)*. The BY condition is a neutral condition.

Cognitive flexibility and conflict monitoring were measured with the *task-switching* paradigm developed by Prior and MacWhinney (2010; based on Rubin & Meiran's, 2005 assessment procedure). Participants were required to sort target stimuli based on either shape or colour, depending on a preceding cue. The cue appeared first for 250 ms, and remained on screen. After 250 ms, the target stimulus appeared, which was either a circle or a triangle, in either red or green colour. The cue and the target stimulus remained on screen for a total of 4000 ms, or until response. Participants were instructed to press the keys “1” and “2” (left hand) for shapes, and “0” and “9” (right hand) for colours; this key-response mapping was counterbalanced across participants. In each case, the red- or circle-related responses were assigned to the middle finger, while the green- or triangle-related responses were assigned to the index finger (stickers with the colours and shapes in black were placed on the corresponding keys). The task consisted of four *pure blocks* (response according to a single rule) of 36 trials each (144 trials in total), and three *mixed blocks* (switch or not between the two rules) of 48 trials each, in a sandwich design (2 single task- 3 mixed-2 single task). In the mixed blocks, there was an equal number (72) of switch trials and repeat trials. Two measures were obtained. *Switching cost* is the difference in performance between Switch trials and Repeat trials, and is reflective of cognitive flexibility. *Mixing cost* is the difference in performance between Repeat trials and Pure trials, and is reflective of conflict monitoring.

Participants first completed the demographic and language background questionnaire, *WAIS-III*, and the *Raven's* tests; followed by the three computerised tasks in counterbalanced order. Then bilingual participants completed the *AMTB*, as well as the *MEIM*, and OGO scales. The assessment session lasted approximately 150 minutes for bilinguals, and 120 minutes for monolinguals, and always took place in a quiet environment.

Analyses. Participants with accuracy rates below 70% were not included in the analyses of the Simon and the Switching tasks. Participants with accuracy rates below 50% in the control condition, and/or zero correct responses in the experimental conditions were not included in the analyses of the AX-CPT. To keep the Results section concise we have included the final N per group and task in the Tables with descriptive statistics. Accurate response times and accuracy rates were submitted to factorial ANOVAs. ANCOVAs with SES or intelligence as covariate were instead reported if the covariate significantly correlated with the given dependent variable (Field, 2013; Wickens, & Keppel, 2004). Bayesian factor analysis for overall RTs, accuracy, and the main language effects were also conducted.

Results

Acculturation Strategy analyses

Inhibitory control. Accurate mean RTs were submitted to 2 x 3 mixed ANOVA, with *Congruency* (neutral, congruent and incongruent) as a within-subjects factor, and *Language Group* as a between-subjects factor (bicultural bilinguals, monocultural bilinguals and monolinguals). The results showed a significant main effect of *Congruency* [$F(2, 131) = 42.41$, $p < .001$, $\eta^2 = .245$], while the main effect of *Language Group* was not significant [$F(2, 131) = .50$, $p = .605$, $\eta^2 = .008$]. Post-hoc comparisons showed that participants were significantly slower on incongruent trials than on both congruent and neutral trials (ps < .001); that is, there was a significant Simon effect. The interaction between *Language Group* and *Congruency* was not significant (ps > .05). A Bayesian univariate ANOVA with overall RTs as the DV, showed substantial evidence for the null hypothesis of a *Language Group* effect ($BF_{01} = 9.04$). A Bayesian ANOVA with the Simon effect showed anecdotal evidence for the null hypothesis of a *Language Group* effect ($BF_{01} = 3.64$), and substantial evidence against the alternative hypothesis ($BF_{10} = .27$).

Mean accuracy rates were submitted to 2 x 3 mixed ANCOVA with *Total SES* as a covariate. The results showed a significant main effect of *Congruency* [$F(2, 260) = 6.91$, $p = .001$, $\eta^2 = .051$], while the main effect of *Total SES* [$F(1, 130) = 2.04$, $p = .155$, $\eta^2 = .015$] and the interaction between *Congruency* and *Total SES* [$F(2, 260) = 2.08$, $p = .127$, $\eta^2 = .016$] were not significant. Post-hoc comparisons showed significant differences between all three conditions of the *Congruency* factor (ps < .05); that is, there were significant conflict effects. The main effect of *Language Group* was not significant [$F(2, 130) = 1.41$, $p = .247$, $\eta^2 = .021$], neither was the interaction between *Congruency* and *Language Group* [$F(4, 260) = 1.15$, $p = .330$, $\eta^2 = .018$]. A Bayesian univariate ANOVA with overall accuracy showed substantial evidence for the null hypothesis of a *Language Group* effect ($BF_{01} = 5.21$).

Cognitive control strategies. A univariate ANOVA with mean accuracy rates for the AX condition, showed a significant main effect of *Language Group* [$F(2, 144) = 3.30$, $p = .040$, $\eta^2 = .044$]. That is, monocultural bilinguals were less accurate than Monolinguals ($p = .011$). A Bayesian univariate ANOVA showed anecdotal evidence both against the null hypothesis of a *Language Group* effect ($BF_{01} = .90$), and for the alternative hypothesis ($BF_{10} = 1.10$).

A 3 x 3 mixed ANOVA for mean accuracy rates in the remaining conditions, with *Trial Condition* as the within-subjects factor (AY, BX, BY) and *Language Group* as the between-subjects factor, showed significant main effects of both *Trial Condition* [$F(2, 288) = 77.53$, $p < .0001$, $\eta^2 = .350$] and *Language Group* [$F(2, 144) = 7.36$, $p = .001$, $\eta^2 = .093$]. There were significant differences between all three conditions (ps < .05), with the highest accuracy in the neutral condition (BY) and the lowest in the proactive control condition (AY). Also, monolinguals were overall more accurate than both bicultural bilinguals and monocultural bilinguals (ps < .05). Lastly, the interaction between *Trial Condition* and *Language Group* was not significant [$F(4, 288) = 1.12$, $p = .344$, $\eta^2 = .015$]. A Bayesian univariate ANOVA with overall accuracy, showed very strong evidence for the alternative hypothesis of a *Language Group* effect ($BF_{10} = 31.89$). Post-hoc tests suggested strong evidence for monolinguals being overall more accurate than bicultural bilinguals (BF_{10} = 16.03), and very strong evidence for monolinguals being more accurate than monocultural bilinguals (BF_{10} = 42.95). A Bayesian univariate ANOVA with the Proactive strategy score (BX–AY), showed substantial evidence for the null hypothesis of a *Language Group* effect (BF_{01} = 7.77).

Cognitive flexibility and conflict monitoring. Accurate mean RTs were submitted to a 2 x 3 mixed ANCOVA with *Trial Type* (Switching cost: switch trials and repeat trials) as a within-subjects factor, *Language Group* as a between-subjects factor, and *Total SES* as a covariate. Results showed significant main effects of *Trial Type* [$F(1, 136) = 29.96$, $p < .0001$, $\eta^2 = .181$] and *Total SES* [$F(1, 136) = 12.42$, $p = .001$, $\eta^2 = .084$], whereas the interaction between *Trial Type* and *Total SES* was not significant [$F(1, 136) = 1.86$, $p = .174$, $\eta^2 = .014$]. That is, there was a significant Switching cost, with participants being faster on repeat trials than on switch trials. The main effect of *Language Group* [$F(2, 136) = .38$, $p = .681$, $\eta^2 = .006$] and the interaction between *Trial Type* and *Language Group* [$F(2, 136) = .56$, $p = .571$, $\eta^2 = .008$] were not significant. A Bayesian univariate ANCOVA with *Total SES* as a covariate and overall RTs (switch and repeat trials), showed anecdotal evidence for the null hypothesis of a *Language Group effect* (BF_{01} = 3.07), and anecdotal evidence against the alternative hypothesis (BF_{10} = .32). A Bayesian ANOVA with Switching cost as the DV, showed substantial evidence for the null hypothesis of a *Language Group* effect (BF_{01} = 7.91).

Results with mean accuracy rates showed a significant main effect of *Trial Type* [$F(1, 137) = 77.60$, $p < .001$, $\eta^2 = .362$], while the main effect of *Language Group* was not significant [$F(2, 137) = 2.79$, $p = .064$, $\eta^2 = .039$]. Overall, participants were more accurate on repeat trials than on switch trials. The interaction between *Trial Type* and *Language Group* was significant [$F(2, 137) = 3.70$, $p = .027$, $\eta^2 = .051$]. Further analyses revealed that there was a significant main effect of *Language Group* only in repeat trials [$F(2, 137) = 3.23$, $p = .042$, $\eta^2 = .045$], in which monocultural bilinguals were significantly less accurate as compared to both bicultural bilinguals and monolinguals (*p*s < .05). A Bayesian univariate ANOVA with overall accuracy, showed anecdotal evidence for the null hypothesis of a *Language Group* effect ($BF_{01} = 1.35$), and anecdotal evidence against the alternative hypothesis ($BF_{10} = .73$).

Accurate mean RTs were submitted to a 2 x 3 repeated measures ANCOVA with *Trial Type* (Mixing cost: repeat trials and pure trials) as a within-subjects factor, *Language Group* as a between-subjects factor, and *Total SES* as a covariate. The results showed significant main effects of *Trial Type* [$F(1, 136) = 39.72$, $p < .001$, $\eta^2 = .226$] and *Total SES* [$F(1, 136) = 13.02$, $p < .001$, $\eta^2 = .087$], and a significant interaction between *Trial Type* and *Total SES* [$F(1, 136) = 5.62$, $p = .019$, $\eta^2 = .040$]. That is, there was a significant Mixing cost, with participants being faster on pure trials than on repeat trials. The main effect of *Language group* [$F(2, 136) = .03$, $p = .966$, $\eta^2 = .001$], and the interaction between *Trial Type* and *Language Group* [$F(2, 136) = 2.30$, $p = .104$, $\eta^2 = .033$] were not significant. A Bayesian univariate ANCOVA with *Total SES* as a covariate and overall RTs (repeat and pure trials) showed substantial evidence for the null hypothesis of a *Language Group* effect ($BF_{01} = 4.25$). An ANCOVA with Mixing cost, showed anecdotal evidence for the null hypothesis of a *Language Group* effect ($BF_{01} = 0.39$), and anecdotal evidence against the alternative hypothesis ($BF_{10} = 2.54$).

Results with mean accuracy rates showed significant main effects of both *Trial Type* [$F(1, 137) = 12.50$, $p = .001$, $\eta^2 = .084$] and *Language Group* [$F(2, 137) = 4.32$, $p = .015$, $\eta^2 = .059$]. Participants were more accurate on pure trials than on repeat trials; and monocultural bilinguals were overall less accurate than both bicultural bilinguals and monolinguals (*p*s < .05). The interaction between *Trial Type and Language Group* was not significant [$F(2, 137) = 1.25$, *p*

= .287, η^2 = .018]. A Bayesian univariate ANOVA with overall accuracy, showed anecdotal evidence against the null hypothesis of a *Language Group* effect (BF_{01} = .38), and anecdotal evidence for the alternative hypothesis (BF_{10} = 2.63).

To sum up, we did not find positive effects of biculturalism on inhibitory control (Simon effect; substantial Bayesian evidence), shifting (Switching cost; substantial Bayesian evidence), or monitoring (Mixing cost or Overall RTs; anecdotal and substantial Bayesian evidence). In terms of accuracy, we found a disadvantage in the Monocultural bilingual group in the colour-shape switching task, relative to both Bicultural bilinguals and Monolinguals (anecdotal Bayesian evidence). In the AX-CPT, Monocultural bilinguals were less accurate than Monolinguals (anecdotal Bayesian evidence) in the AX condition. In all remaining conditions both bilingual groups were less accurate than Monolinguals (very strong Bayesian evidence). Lastly, there were no differences in cognitive control strategy, due to acculturation (biculturalism; substantial Bayesian evidence).

Analyses as a function of linguistic distance

Inhibitory Control. Mean accurate RTs times were submitted to a 4 x 3 ANOVA with *Linguistic distance* (Turkish-Albanian, Bosnian-Albanian, Albanian-Greek and Albanian monolinguals) as the between-subjects factor and *Congruency* as within-subjects factor. The main effects of *Linguistic Distance* [F (3, 167) = 6.26, $p < .001$, η^2 = .10)] and *Congruency* [F (2, 334) = 53.59, $p < .001$, η^2 = .24)], and their interaction [F (6, 334) = 2.47, p = .023, η^2 = .04)] reached statistical significance. Albanian monolinguals had overall slower RTs than the other three bilingual groups, Turkish-Albanian (p =.008), Albanian-Greek ($p < .001$) and Bosnian-Albanian (p = .001). RTs were also significantly slower in the incongruent condition relative to the congruent and neutral conditions (*p*s < .001); that is, there was a significant Simon effect. The analysis of the interaction with the Simon effect ($RT_{Incongruent}$-$RT_{Congruent}$), showed that Albanian Monolinguals (16 ms of effect) and Bosnian-Albanian bilinguals (14 ms of effect) had significantly smaller Simon effects than Turkish-Albanian (30 ms of effect) and Albanian-Greek Bilinguals (35 ms of effect), all *ps* < .05. No other comparison reached statistical significance. A Bayesian univariate ANOVA with overall RTs showed strong evidence for the alternative hypothesis of a *Linguistic Distance* effect (BF_{01} = 53.67). Post-hoc analysis suggested very strong evidence for Albanian monolinguals being slower than Albanian-Greek bilinguals (BF_{10}= 66.86), and substantial evidence for Albanian monolinguals (BF_{10}= 3.55) being slower than Bosnian-Albanian bilinguals. A Bayesian ANOVA with the Simon effect, showed extreme evidence for the alternative hypothesis of a *Linguistic Distance* effect (BF_{10} = 246.20).

Analyses with mean accuracy rates showed significant main effects of *Linguistic Distance* [F (3, 167) = 6.62, p < .001, η^2 = .10)] and *Congruency* [F (2, 334) = 37.44, p < .001, η^2 = .18)], as well as a significant interaction [F (6, 334) = 5.63, p < .001, η^2 = .10)]. Overall, Albanian monolinguals (.95) and Bosnian-Albanian bilinguals (.96) both had overall higher accuracy than Albanian-Greek bilinguals (.92, *ps* < .05). In addition, mean accuracy was significantly lower in the incongruent condition, relative to the congruent and neutral conditions (*p*s < .001). The analysis of the interaction showed the main effect of *Linguistic Distance* was significant for incongruent [F (3, 167) = 9.49, p < .001] and neutral trials [F (3, 167) = 4.26, p < .05], but not for congruent trials [F (3, 167) = 5.8, p = .629]. Albanian monolinguals (.95 and .95) and Bosnian-Albanian bilinguals (.96 and .95) were significantly more accurate than Albanian-Greek bilinguals (.93 and.88, *ps* < .05) on both incongruent and neutral trials. A Bayesian univariate ANOVA with overall accuracy, showed extreme evidence for the alternative hypothesis of a *Linguistic Distance* effect (BF_{10} = 104.85). Post-hoc analysis shows extreme evidence for Albanian-Greek bilinguals being less accurate than Bosnian-Albanian (BF_{10} = 124.27), and very strong evidence for Albanian-Greek being less accurate than Albanian Monolinguals (BF_{10} = 54.39).

Cognitive control strategies. A univariate ANOVA with mean accuracy data for the control condition (AX) yielded a non-significant main effect of *Linguistic Distance* [F (3, 181) = .73, p = .535, η^2=.01]. A Bayesian univariate ANOVA showed anecdotal evidence against the null hypothesis of a *Linguistic Distance* effect (BF_{01} = .90), and anecdotal evidence for the alternative hypothesis (BF_{10} = 1.10).

Analyses for the AY, BX, and BY trials, showed that the main effects of *Trial Condition* [F (2, 372) = 130.23, p < .001, η^2=.41)] and *Linguistic Distance* [F (3, 185) = 15.58, p < .001, η^2=.24)] were significant. Post-hoc comparisons showed significant differences between all three conditions (*p*s < .05), with the highest accuracy in the BY condition and the lowest in the AY condition. Also, Albanian monolinguals and Bosnian-Albanian bilinguals had higher overall accuracy than Turkish-Albanian and Albanian-Greek bilinguals, all ps < .01. The *Trial Condition* by *Linguistic Distance* interaction [F (4.7, 292.6) = 20.12, p < .001, η^2 = .24)] also reached statistical significance. Turkish-Albanians had significantly higher Proactive strategy score (BX-AY difference score) than Albanian monolinguals, Bosnian-Albanian and Albanian-Greek (all *ps* <.001). Also, Bosnian-Albanian had significantly higher Proactive strategy score than Albanian-Greek bilinguals (p =.008). No other comparison reached statistical significance. A Bayesian univariate ANOVA with overall accuracy showed substantial evidence for the null hypothesis of a *Linguistic Distance* effect (BF_{01} = 3, 94). Bayesian univariate ANOVA with the Proactive strategy score (BX–AY) as the DV, showed substantial evidence for the null hypothesis of a *Linguistic Distance* effect (BF_{01} = 7.77).

Cognitive flexibility and conflict monitoring. For the Switching cost, mean accurate RTs were submitted to 4 x 2 ANCOVA with *Intelligence* score as a covariate. The main effect of *Trial type* was not significant [F (1, 175) = .10, p = .743, η^2=.00)]. The main effect of *Linguistic Distance* [F (3, 175) = 10.09, p < .001, η^2 =. 14] and the interaction *Linguistic Distance* by *Trial Type* [F (3, 175) = 4.23, p < .001, η^2 = .06] were significant. Bosnian-Albanian bilinguals were overall faster than Albanian monolinguals and the other two bilingual groups (*ps* < .05). Bosnian -Albanian bilinguals had also smaller Switching cost effects (RT_{Switch} – $RT_{NonSwitch}$) than Turkish-Albanians bilinguals (*p* < .05). No other comparison reached statistical significance. A Bayesian univariate ANCOVA with overall RTs and *Intelligence* scores as a covariate showed anecdotal evidence for the null hypothesis of a *Linguistic Distance effect* (BF_{01} = 1.97), and anecdotal evidence against the alternative hypothesis (BF_{10} = .50). A Bayesian univariate ANCOVA with *Intelligence* scores as a covariate and Switching cost showed substantial evidence for the null hypothesis (BF_{01} = 6.19) of a *Linguistic Distance* effect.

Results with mean accuracy rates showed that the main effect of *Trial type* [F (1, 175) = .09, p = .761, η^2 = .01] did not reach statistical significance. The main effect of *Linguistic Distance* [F (3, 175) = 12.52, p < .001, η^2 = .17] was significant; Bosnian-Albanian bilinguals and Albanian Monolinguals had significantly higher accuracy than Turkish-Albanians and Albanian-Greek bilinguals (*ps* < .05). No other comparison reached statistical significance. The interaction between *Linguistic Distance* and *Trial Type* was not significant [F (3, 175) = .53, p = .662, η^2 = .01]. A Bayesian univariate ANCOVA with overall accuracy and *Intelligence* scores as a covariate showed anecdotal evidence for the alternative hypothesis of a *Linguistic Distance* effect ($BF_{10} = 1.28$), and anecdotal evidence against the null hypothesis ($BF_{01} = .77$).

RTs analyses for the Mixing cost showed that the main effect of *Trial type* [F (1, 175) = 1.87, $p = .173$, $\eta^2 = .01$] was not significant. The main effect of *Linguistic Distance* [F (3, 175) = 10.69, $p < .001$, $\eta^2 = .15$], and the interaction *Linguistic Distance* by *Trial Type* [F (3, 175) = 12.73, $p < .001$, $\eta^2 = .17$] were significant. Bosnian-Albanian bilinguals had faster overall RTs than Albanian monolinguals and Albanian-Greek bilinguals; and Turkish-Albanian bilinguals had also faster overall RTs than Albanian monolinguals (all *ps* < .05). Also, Bosnian-Albanian bilinguals had significantly smaller in magnitude Mixing cost than Turkish-Albanian and Albanian-Greek bilinguals (all *ps* < .05). The latter group also had significantly larger in magnitude Mixing costs than Albanian monolinguals (p < .05). No other comparison reached statistical significance. A Bayesian univariate ANCOVA with overall RTs and *Intelligence* scores as a covariate showed anecdotal evidence for the null hypothesis of a *Linguistic Distance* effect ($BF_{01} = 1.67$) and anecdotal evidence for the alternative ($BF_{10} = .59$). An ANCOVA with Mixing cost showed anecdotal evidence for the null hypothesis of a *Linguistic Distance* effect ($BF_{01} = 1.80$), and anecdotal evidence against the alternative hypothesis ($BF_{10} = 0.55$).

Results with mean accuracy rates showed that the main effect of *Trial type* [F (1, 175) = 1.66, $p = .198$, $\eta^2 = .01$] was not significant. The main effect *Linguistic Distance* [F (3, 175) = 10.62, $p < .001$, $\eta^2 = .15$] and the interaction *Linguistic Distance* by *Trial Type* [F (3, 175) = 4.99, $p < .05$, $\eta^2 = .08$] were significant. Both Albanian monolinguals and Bosnian-Albanian bilinguals had higher overall accuracy than Turkish-Albanian and Albanian-Greek bilinguals (all *p*s <.05). No other comparison reached statistical significance. The analysis of the interaction showed that for both pure and repeat trials Bosnian-Albanian bilinguals and Albanian monolinguals were significantly more accurate than Turkish-Albanian and Albanian-Greek (all *ps* <.05), but the difference was greater for repeat trials. No other comparison reached statistical significance. A Bayesian univariate ANCOVA with overall accuracy showed extreme evidence for the alternative hypothesis of a *Linguistic Distance* effect (BF_{10} = 115.28). Post-hoc analysis suggests extreme evidence for Bosnian-Albanian being more accurate than Turkish-Albanian (BF_{10} = 7504.47) and Albanian-Greek bilinguals (BF_{10} = 8872.95), and anecdotal evidence for the same group (Bosnian-Albanian) being more accurate than Albanian monolinguals (BF_{10} = 1.03). Also, there was strong and very strong evidence for Albanian monolinguals being more accurate than Albanian-Turkish (BF_{10} = 25.27) and Albanian-Greek bilinguals (BF_{10} = 54.90).

To sum up, none of the bilingual groups, regardless of linguistic distance, outperformed the monolingual group in inhibitory control (Simon effect), shifting (Switching cost) or monitoring (Mixing cost). The Bosnian-Albanian bilinguals were overall faster than the monolinguals and the other bilingual groups in the Simon task (strong Bayesian evidence), and the switching task (anecdotal Bayesian evidence); they also had better performance than Turkish-Albanian bilinguals in inhibitory control (Simon effect; extreme Bayesian evidence), shifting (Switching cost; substantial Bayesian evidence), and monitoring (anecdotal Bayesian evidence). Albanian-Greek bilinguals had also worse performance in monitoring (mixing cost) than monolinguals (anecdotal Bayesian evidence). In the AX-CPT, the Greek-Albanian and the Turkish-Albanian bilinguals were overall less accurate than the Monolinguals and the Bosnian-Albanian Bilinguals; whereas the Turkish-Albanian bilinguals had the highest proactive strategy score, relative to all other groups, and the Bosnian-Albanian bilinguals had also higher proactive scores than the Greek-Albanian bilinguals. However, these results were not supported by Bayesian evidence.

Cluster Analyses: Bilingual profile

To investigate whether the sociolinguistic profile of bilingual participants modulates possible cognitive advantages, we conducted hierarchical cluster analysis using Ward's (1963) minimum variance and squared Euclidian distance methods, combined with *k*-means cluster analysis. Ward's method is generally regarded as one of the most efficient clustering algorithms for retrieving underlying data structures (Aldenderfer & Blashfield, 1984; Borgen & Barnett, 1987), while minimizing within-cluster variance at each step of the algorithm. The following seven variables were entered into the analysis: relative proficiency (ratios) in the two languages spoken, relative frequency of language use (ratio), bilingualism onset, language switching, motivation and attitudes towards bilinguals' L2 development, as well as ethnic identity and other-group orientation (acculturation) scores. These variables were chosen given their theoretical importance in the bilingual cognitive advantage literature, and they all significantly correlated with the cognitive outcome measures. Data of the full bilingual sample ($N = 201$) were included, and all scores were standardized before performing the cluster analysis.

In determining the most appropriate number of clusters to describe our data, we first relied on the agglomeration schedule. It suggested that the largest change in error coefficients in our data occurred when one cluster was reduced to two; indicating a significant typology at a two-cluster solution. This decision was then verified by visual inspection of the dendrogram. We then conducted *k*-means cluster analysis to minimize within-group variance and maximize between-group variance, which resulted in two clusters: one consisting of 130 bilingual participants, and a second of 71 bilingual participants. Univariate ANOVA analyses showed that the two clusters differed significantly on all variables, except for language switching. That is, the bilinguals of the second cluster had significantly less balanced language proficiency and frequency of language use ratios, later bilingualism onset, lower scores on the scale assessing motivation and attitudes associated with learning a language other than the native tongue, higher ethnic identity, and lower other-group orientation, relative to the bilinguals of the second cluster. Thus, we interpreted the two clusters accordingly, as a subgroup with an unbalanced bilingual profile ($N_{\text{unbalanced}} = 71$), and a subgroup with a balanced bilingual profile ($N_{\text{Balanced}} = 130$; see supplementary Table 2 for demographics, intelligence and language background characteristics per group). In the balanced profile group, 25% and 23% of the participants were included in the bicultural and monocultural groups respectively, whereas 8% were Albanian-Serbian, 36% Bosnian-Albanian, 28% Turkish-Albanian, and 28% were Albanian-Greek. While in the unbalanced profile group, 16% and 38% of the participants were included in the bicultural and monocultural groups respectively, and 56% were Albanian-Serbian, 6% Bosnian-Albanian, 20% Turkish-Albanian, and 18% were Albanian-Greek. We then conducted analyses for the cognitive tasks, with Bilingual Profile (balanced bilingual profile, unbalanced bilingual profile and monolingual profile) as the between-subjects factor.

Inhibitory control. RTs analyses for the Simon task yielded significant main effects of *Congruency* [$F(2, 532) = 78.67$, $p < .001$, $\eta^2 = .228$] and *Bilingual Profile* [$F(2, 266) = 3.67$, $p = .027$, $\eta^2 = .027$]. Specifically, participants had slower RTs in incongruent trials as compared to both congruent and neutral trials (ps < .001), and unbalanced profile bilinguals had slower RTs as compared to both other groups (ps < .05), which did not differ. The interaction between *Congruency* and *Bilingual Profile* was not significant [$F(4, 532) = .43$, $p = .783$, $\eta^2 < .003$]. A Bayesian univariate ANOVA with overall RTs as the DV, showed anecdotal evidence against the null hypothesis of a *Bilingual Profile* effect ($BF_{01} = .95$), and anecdotal evidence for the alternative hypothesis ($BF_{10} = 1.04$). The ANOVA with the Simon effect as the DV, showed strong evidence for the null hypothesis of a *Bilingual Profile* effect ($BF_{10} = 11.35$).

Accuracy analyses, with non-verbal intelligence as a covariate, showed that the main effect of *Congruency* was not significant [$F(2, 530) = 2.46$, $p = .086$, $\eta^2 = .009$], while the main effect of *Bilingual Profile* was significant [$F(2, 265) = 3.75$, $p = .025$, $\eta^2 = .028$]. That is, balanced profile bilinguals had overall lower accuracy as compared to both other groups (*p*s < .05), which did not differ. The interaction between *Congruency* and *Bilingual Profile* was not significant [$F(4, 530) = 1.04$, $p = .383$, $\eta^2 = .008$]. A Bayesian univariate ANCOVA for overall accuracy and *Intelligence* scores as a covariate showed substantial evidence for the alternative hypothesis of a *Bilingual Profile* effect ($BF_{10} = 9.25$). However, post-hoc comparisons only showed anecdotal evidence for balanced profile bilinguals being overall less accurate than both unbalanced profile bilinguals ($BF_{10} = 2.16$) and monolinguals ($BF_{10} = 2.87$).

Cognitive control strategies. For the AX-CPT, ANCOVA analyses for AX trials, with *Intelligence* scores as a covariate, showed a significant main effect of *Bilingual Profile* [$F(2, 285) = 5.33$, $p = .005$, $\eta^2 = .036$]. Balanced profile bilinguals had lower accuracy on AX trials as compared to monolinguals ($p = .001$). No other comparison reached statistical significance. A Bayesian univariate ANCOVA for AX trial accuracy, with *Intelligence* as a covariate showed very strong evidence for the alternative hypothesis of a *Bilingual Profile* effect ($BF_{10} = 44.74$). That is, there was very strong evidence for balanced profile bilinguals being less accurate than monolinguals ($BF_{10} = 44.81$). For the AY, BX and BY conditions, the main effects of *Trial Condition* [$F(2, 572) = 144.79$, $p < .001$, $\eta^2 = .336$] and *Bilingual Profile* [$F(2, 286) = 14.12$, $p < .0001$, $\eta^2 = .090$], and the *Trial Condition* by *Bilingual Profile* interaction [$F(4, 572) = 5.66$, $p <$

.0001, $\eta^2 = .038$] were significant. There were significant differences between all three trial conditions (ps < .001), with the highest accuracy in the BY condition, and the lowest accuracy in the AY condition. Balanced profile bilinguals had overall lower accuracy as compared to both other groups (ps < .05), and a significantly higher proactive strategy score as compared to both other groups (ps < .05), which did not differ. A Bayesian univariate ANOVA with overall accuracy, showed extreme evidence for the alternative hypothesis of a *Bilingual Profile* effect ($BF_{10} = 11686.32$). That is, there was strong evidence for balanced profile bilinguals being overall less accurate than unbalanced profile bilinguals ($BF_{10} = 10.24$), and extreme evidence for balanced profile bilinguals being overall less accurate than monolinguals ($BF_{10} = 24314.03$). The ANOVA with the Proactive strategy score as the DV, showed substantial evidence for the alternative hypothesis of a *Bilingual Profile* effect ($BF_{10} = 7.31$). Specifically, there was strong evidence for balanced profile bilinguals having a larger proactive strategy score than monolinguals ($BF_{10} = 14.50$).

Cognitive Flexibility and Conflict Monitoring. For the Colour-Shape switching Task, an ANOVA with mean accurate RTs for switch trials and repeat trials (Switching Cost) showed significant main effects of *Trial Type* [$F(1, 276) = 390.54$, $p < .001$, $\eta^2 = .586$] and *Bilingual Profile* [$F(2, 276) = 7.11$, $p = .001$, $\eta^2 = .049$], but the interaction between *Trial Type* and *Bilingual Profile* was not significant [$F(2, 276) = 1.46$, $p = .232$, $\eta^2 = .011$]. That is, participants had slower RTs in switch trials as compared to repeat trials ($p < .001$), and unbalanced profile bilinguals were overall slower that the other two groups (ps < .05), which did not differ. A Bayesian univariate ANOVA with overall RTs, showed strong evidence for the alternative hypothesis of a *Bilingual Profile* effect ($BF_{10} = 21.94$). That is, there was very strong evidence for unbalanced profile bilinguals being overall slower than balanced profile peers ($BF_{10} = 65.11$).

The ANOVA with Switching cost showed substantial evidence for the null hypothesis of a *Bilingual Profile* effect ($BF_{01} = 6.81$).

An ANCOVA with mean accuracy rates, with non-verbal intelligence as a covariate, showed a significant main effect of *Trial Type* [$F(1, 275) = 6.80$, $p = .010$, $\eta^2 = .024$], with participants being more accurate on repeat trials than on switch trials ($p < .001$). The main effect of *Bilingual Profile* was not significant [$F(2, 275) = 2.75$, $p = .066$, $\eta^2 = .020$]. The interaction between *Trial Type* and *Bilingual Profile* was significant [$F(2, 275) = 4.31$, $p = .014$, $\eta^2 = .030$]. Further analyses showed that there were group differences only in switch trials [$F(2, 275) = 4.60$, $p = .011$, $\eta^2 = .032$], with balanced profile bilinguals being less accurate than monolinguals ($p = .003$). No other comparison for switch trials reached statistical significance. There were no group differences in repeat trials [$F(2, 275) = .62$, $p = .538$, $\eta^2 = .005$]. A Bayesian univariate ANCOVA with overall accuracy and non-verbal intelligence scores as a covariate showed anecdotal evidence against the null hypothesis of a *Bilingual Profile* effect ($BF_{01} = .54$), and anecdotal evidence for the alternative hypothesis ($BF_{10} = 1.84$).

An ANOVA with mean accurate RTs for Repeat and Pure trials (Mixing cost) showed significant main effects of *Trial Type* [$F(1, 276) = 406.57$, $p < .0001$, $\eta^2 = .596$] and *Bilingual Profile* [$F(2, 276) = 10.89$, $p < .0001$, $\eta^2 = .073$]. Participants had slower RTs in repeat trials as compared to pure trials ($p < .001$). Post-hoc comparisons revealed significant group differences between all three conditions of the *Bilingual Profile* factor (ps < .05), with balanced profile bilinguals being the fastest overall, and unbalanced profile bilinguals being the slowest overall. The *Trial Type* by *Bilingual Profile* interaction was also significant [$F(2, 276) = 7.47$, $p = .001$, $\eta^2 = .051$]. Further analyses showed that unbalanced profile bilinguals had a significantly larger Mixing cost as compared to both other groups (ps = .001), which did not differ. A Bayesian univariate ANOVA with overall RTs showed extreme evidence for the alternative hypothesis of a *Bilingual Profile* effect (BF_{10} = 603.62). That is, there was extreme evidence for balanced profile bilinguals being overall faster than unbalanced profile peers (BF_{10} = 962.30), and anecdotal-to-substantial evidence for balanced profile bilinguals being overall faster than monolinguals (BF_{10} = 3.74). An ANOVA with Mixing cost as the DV, showed strong evidence for the alternative hypothesis of a *Bilingual Profile* effect (BF_{10} = 28.39). That is, there was strong evidence for unbalanced profile bilinguals having a larger Mixing cost than balanced profile peers (BF_{10} = 18.50), and very strong evidence for unbalanced profile bilinguals having a larger Mixing cost than monolinguals (BF_{10} = 56.01).

An ANCOVA with mean accuracy rates, and with non-verbal intelligence scores as a covariate, showed that the main effects of *Trial Type* [$F(1, 275) = .80$, $p = .369$, $\eta^2 = .003$] and *Bilingual Profile* were not significant [$F(2, 275) = 2.34$, $p = .098$, $\eta^2 = .017$]. The interaction between *Trial Type* and *Bilingual Profile* was also not significant [$F(2, 275) = .1.59$, $p = .205$, $\eta^2 = .011$]. A Bayesian univariate ANCOVA with overall accuracy and non-verbal intelligence scores as a covariate showed substantial evidence for the alternative hypothesis of a *Bilingual Profile* effect (BF_{10} = 8.42). However, post-hoc comparisons showed only anecdotal evidence for balanced profile bilinguals being overall less accurate than monolinguals (BF_{10} = 2.58).

To sum up, results did not support a positive effect of *Bilingual profile* on inhibitory control (Simon effect; strong Bayesian evidence) or shifting (Switching cost; substantial Bayesian evidence). In terms of monitoring, unbalanced profile bilinguals performed worse than balanced profile bilinguals and monolinguals (Mixing cost and Overall RT; strong Bayesian evidence). In the AX-CPT, balanced profile bilinguals were less accurate than Monolinguals (AX, BY and AY conditions; very strong/extreme Bayesian evidence), and Unbalanced profile bilinguals (AY condition; extreme Bayesian evidence); and relied more on proactive control than on reactive control relative to the other two groups (higher proactive strategy score; strong Bayesian evidence).

Discussion

Going beyond prior work and adopting a comprehensive approach to bilingual experiences in different bilingual populations of the Balkan region, the present study aimed to explore linguistic and sociocultural correlates of bilingual cognitive performance in multiple domains. Specifically, we examined whether factors such as linguistic distance, the acculturation strategy adopted by bilinguals, or the socio-linguistic-affective bilingual profile may modulate the bilingual cognitive advantage. These factors have to date received very little attention in the literature, whereas no studies so far have explored their combined effects to cognitive development and performance. We hypothesized that taking into account linguistic, affective, as well as sociocultural variables, might elucidate *under which specific conditions* bilingual cognitive advantages may emerge.

To that end, we first formed bilingual groups based on their acculturation strategy, and compared bicultural and monocultural strategy bilinguals with monolingual peers on inhibitory control, cognitive control strategies (proactive vs. reactive), cognitive flexibility, and conflict monitoring. Overall, we did not find systematic evidence for the bilingual cognitive advantage hypothesis and relevant modulation by the sociocultural factors considered. That is, although we found the significant (standard) Simon interference, Switching cost and Mixing cost effects, neither bilingualism (see supplementary material for analysis with all bilinguals in a single group), nor biculturalism had a positive effect on these cognitive measures. Bayesian analyses largely supported these findings. In fact, monocultural bilinguals had overall lower accuracy than monolinguals (AX-CPT and Switching task), and bicultural bilinguals (switching task). There was also strong evidence for monocultural and bicultural bilinguals having lower overall accuracy than monolinguals in the AX-CPT.

We then investigated the effect of linguistic distance, and compared the Turkish-Albanian bilinguals (speaking rather distant languages), with the Albanian-Greek and Bosnian-Albanian groups (speaking more similar languages), and the monolingual peers. Our results did not support the *cross-linguistic interference hypothesis* (Blumenfeld & Marian, 2013; Bialystok, 2007; Costa et al., 2008), which predicts that bilinguals speaking similar languages would demonstrate superior performance in resolving cognitive interference. Findings were actually mixed: Bosnian-Albanian bilinguals, (less distant languages), had faster overall response times (in the Simon and Switching tasks) than monolinguals. Bayesian analyses supported this sole evidence of a bilingual advantage in general monitoring (overall RT). The Bosnian-Albanian group had also better inhibitory control (smaller Simon effect), switching ability (smaller Switching cost), conflict monitoring (smaller mixing cost), as well as overall accuracy and response times across all tasks, relative to the other two bilingual groups. However, Albanian-Greek bilinguals, who were classified as having less distant languages, along with Bosnian-Albanian bilinguals, and were thus not expected to differ from each other, at least based on this grouping criterion, actually had significantly worse performance than monolingual participants in inhibitory control (Simon effect), conflict monitoring (mixing cost), and overall accuracy across all tasks. Actually, the performance of the Albanian-Greek group was very similar to that of Turkish-Albanian bilinguals, who spoke the more distant languages. So, it seems that linguistic distance *per se* cannot account for the present findings, and that any positive effect of bilingualism seems to be restricted to the population of Bosnian-Albanian bilinguals.

Finally, we tested the hypothesis that the combination or interaction of several linguistic, affective, as well as acculturation-related factors may facilitate the demonstration of positive bilingualism effects. We did not find systematic or strong evidence in support, however. Based on cluster analyses, we divided the bilingual sample into balanced and unbalanced bilingual profile participants. The balanced bilingual profile group had significantly more balanced proficiency and frequency of language use (ratios), earlier bilingualism onset, higher scores on the scale reflecting attitudes and motivation associated with learning a language other than the native tongue, lower ethnic identity, and higher other-group orientation than the unbalanced profile bilingual group. To our knowledge, this is the third study using cluster methodology (Hindle et al., 2015; Von Bastian et al., 2016), but the first to include social, affective (motivation – attitudes), as well as acculturation-related variables to form clusters. There was strong evidence that the unbalanced profile bilingual group had worse conflict monitoring capacity (a greater mixing cost effect) and response times (in the Simon and Switching tasks) that monolinguals and balanced profile bilinguals. However, there was also strong evidence that the balanced profile bilingual group was less accurate overall as compared to both other groups, in the Simon and the AX-CPT tasks, and less accurate than monolinguals in Switch trials.

Since the AX-CPT task has been used only in a few recent studies, and the findings are not that easily interpreted in terms of better or worse performance, we discuss them separately. According to *the dual mechanisms of cognitive control* approach (Morales et al., 2013; 2015), bilinguals are regarded better able to adjust their use of proactive and reactive control strategies to reach optimal cognitive performance. Thus, they are expected to perform better in the AY condition, which involves both *proactive* control (to maintain activation of the cue A and response, since in 70% of the trials it will be followed by the correct X probe) and *reactive* control (to supress the prepotent response when the Y probe appears, instead of the expected X probe). In a later study, Gullifer and colleagues (2018) employed a *proactive strategy score* (BX-BY); again smaller scores would reflect more balanced control management, with less reliance on proactive control, and therefore less errors in the AY condition. Contrary to this prediction and previous findings (Morales et al., 2013; Morales et al., 2015), we found strong evidence that the group of balanced profile bilinguals had a significantly larger proactive strategy score than either the monolingual, or the unbalanced profile bilingual groups. That is, they had lower accuracy on the AY condition, which suggests that more greatly relied on monitoring (proactive control), rather than on inhibitory control processes (reactive control). This suggests that the group of balanced profile bilinguals might have been less flexible in applying control strategies; since too much reliance on proactive control may lead to more errors when the probe does not fit with the expectations. On the other hand, acculturation did not significantly influence proactive vs. reactive control management. Finally, when linguistic distance was taken into account, Bosnian-Albanian bilinguals, who outperformed the other groups in several measures showed better overall accuracy than the other two bilingual groups, and a significantly smaller proactive strategy score than Turkish-Albanian bilinguals; they did not differ from monolinguals though. It should be noted that although the Albanian-Greek bilinguals had the lowest proactive strategy score, they actually had a negative score. Moreover, they had the lowest overall accuracy, including the neutral BY condition. It seems that this group did not follow task-instructions properly, maybe due to working memory limitations or a different (seen as "more efficient") strategic approach to the task.

Overall, in line with many recent studies (e.g., Antón et al., 2016; Duñabeitia et al., 2014; Ladas et al., 2015; Paap et al., 2015; Vivas et al., 2017; Von Bastian et al., 2016) and meta-analyses (e.g., Lehtonen et al., 2018), we did not find consistent and substantial evidence in support of a bilingual cognitive advantage, when grouping participants based on either acculturation strategy (bicultural vs. monocultural), or bilingual profile (balanced vs. unbalanced). In the last decade, many authors have supported that specific factors related to bilingualism, such as bilingualism onset (e.g., Luk et al., 2011), language switching frequency (e.g., Prior & Gollan, 2011; Soveri et al., 2011; Verreyt et al., 2016; Woumans et al., 2015), bilingualism type in terms of how balanced language development is (in terms of proficiency; e.g., Bialystok et al., 2006; Woumans et al., 2015; Yow & Li, 2015), or type of interactional context (e.g., Guerrero et al., 2015; Hartanto & Yang, 2016), may account for discrepancies in the findings regarding the bilingual advantage. Our results are aligned, however, with recent studies that have failed to find systematic evidence for relevant significant effects (e.g., Antón et al., 2014; Gathercole et al., 2014; Kousaie & Phillips, 2012; Paap & Greenberg, 2013; Paap & Sawi, 2014; Paap et al., 2017; Scaltritti et al., 2017).

Yet, among bilinguals, the Bosnian-Albanian group actually outperformed the other two bilingual groups in most measures; as well as the monolingual group in general monitoring (overall RTs). This finding can't be explained in terms of Linguistic distance per se, since Albanian-Greek bilinguals, who were classified as speaking less distant languages, performed differently. Interestingly, this group had the highest overlap (92% of the participants) with the balanced bilingual profile cluster. That is, this group had the highest percentage of integrated bilinguals, the earliest bilingualism onset together with Turkish-Albanian bilinguals, and the more positive affective reactions towards groups, individuals, and concepts associated with learning a language other than their native tongue (motivation and attitudes scale score; see Table 2). Yet, the balanced profile bilinguals did not outperform monolinguals in any of the measures. Moreover, the Bosnian-Albanian group had significantly higher support of bilingualism status and maintenance by formal education, relative to the Albanian-Greek and Turkish-Albanian groups (smaller absolute magnitude of the difference in years of official education in the two languages spoken; see Table 2). Formal education in the languages spoken has been shown to modulate the effect of bilingualism on cognition (see Bialystok, 2018 for a review), so differences in this factor may have contributed to the better performance of the Bosnian-Albanian group.

Finally, in line with other studies (e.g. Gathercole et al., 2014; Paap & Greenberg, 2013; Paap et al., 2014), bilingual participants underperformed monolingual peers in several cases. Specifically, monocultural bilinguals had consistently worse overall accuracy as compared to both monolinguals and bicultural bilinguals. This finding might be explained by suggestions for acculturation effects on cognitive performance that are independent of bilingualism. Several studies have reported that participants who are not successfully acculturated in a host society tend to experience higher levels of stress (Caetano et al., 2007) and discrimination (Noh & Kaspar, 2003), have poorer mental health (Ruzek et al., 2011; Yoon et al., 2012), and show poorer performance in tasks assessing information processing (Razani et al., 2007), working memory (Coffey et al., 2005) or attention (Arentoft et al., 2012). Thus, the effect of acculturation may be confounded with that of bilingualism on cognitive performance. This may explain the worse performance in conflict monitoring and general monitoring of the unbalanced profile bilinguals, who had higher ethnic identity and lower other-group orientation (characteristics of a separation strategy).

Another interesting finding, which was actually not within the main scope of the present study, is that of a positive relationship between acculturation (biculturalism) and bilingualism.

That is, bicultural bilinguals had higher self-reported proficiency in both languages spoken, higher frequency of L1 and L2 use, and higher scores on the scale measuring attitudes and motivation regarding second language learning, relative to monocultural bilinguals (see supplementary Table 1). The latter is aligned with evidence stemming from studies investigating acculturation and second language learning in students while adjusting to living abroad during their studies, or in students learning foreign languages, as part of the curriculum at school (e.g., Gardner, 2001, 2007; Lai et al., 2015; Lee, 2001; Masgoret & Ward, 2006; Okuniewska et al., 2010). As such, the present study adds to this literature by further supporting links between acculturation, affective reactions toward groups, individuals, and concepts associated with learning a language other than the native tongue, and indices related to language development, such as bilingualism onset and language proficiency; yet, as a function of prolonged bilingual experience in young adults, who are immigrants or ethnic group members. It should be noted that one limitation of the present study was that our monocultural group consisted of bilinguals with both assimilation and separation strategies, whereas, we did not find marginalised bilinguals. Future research, also focusing on geographical areas where different bilingual – ethnic groups have been formed due to historical - migration reasons, might succeed in conducting a more fine-grained investigation of the differential effects of all four acculturation strategies suggested within the specific theoretical framework.

In conclusion, we did not find systematic evidence for a positive effect of bilingualism, biculturalism, or of a balanced bilingual profile on inhibitory control, cognitive flexibility and monitoring, or proactive-reactive control management. In fact, Bayesian analyses showed substantial evidence for the lack of relevant effects on inhibitory control and cognitive flexibility. Yet, they showed substantial evidence for an effect of acculturation/biculturalism and bilingual profile on conflict monitoring, and proactive-reaction control management, however, in the opposite direction than the one predicted by the bilingual advantage hypothesis.

These findings suggest that the bilingual cognitive advantage effect may be restricted to particular populations and cognitive measures. The only evidence pointing to a bilingual advantage in our study was observed in our Bosnian-Albanian bilingual group, and in overall response times. However, better performance of this group did not seem to be driven by linguistic distance, or by the linguistic, affective, and acculturation factors included in the cluster analyses; with only some of the findings actually supported by Bayesian analyses. We suggest that formal education in the languages spoken could have contributed to the performance of this group, although we did not directly test this hypothesis.

Acculturation (biculturalism), on the other hand, clearly played an important role in shaping the overall bilingual profile, and was associated with the language-related variables examined here, as they have been suggested to modulate the bilingual advantage (see de Bruin, 2019 for a discussion). The relationship between acculturation and bilingualism is certainly bidirectional; higher and more balanced degree of bilingualism is likely to result in more successful acculturation in a host society, and a more bicultural orientation in turn (e.g., Masgoret & Gardner, 2003; Masgoret & Ward, 2006; Yu, 2010; Yu & Downing, 2012). Yet, acculturation/biculturalism appeared to have independent effects from bilingualism on cognitive performance. These findings suggest that not being well-integrated in a host society (being a monocultural or unbalanced profile bilingual) may set obstacles to bilingual cognitive development (e.g., Arentoft et al., 2012; Coffey et al., 2005; Kennepohl et al., 2004; Manly et al., 2004; Manly et al., 1998; Razani, et al., 2007), thus, "masking" any positive effects of bilingual experience. Future studies can directly explore such effects, including younger age groups as well or adopting a longitudinal design. Beyond the current polarized, "*yes vs. no*" debate on the existence of a bilingual advantage (see Woumans & Duyck, 2015 for a discussion), we believe that shedding further light into bilingual profiles can only move the field forward, by allowing for a more in depth exploration of the complex interplay between the individual and environmental factors that shape cognitive development more generally.

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Table 1. Genealogical and Typological Classification of the Turkish, Greek, Albanian, and Bosnian languages.

	Turkish	**Serbian-Bosnian**	**Greek**	**Albanian**
Genealogical classification Language families	Turkic	Indo-European	Indo-European	Indo-European
Typological classification				
Syntax				
Word order (predominant pattern)	SOV	SVO	SVO	SVO
Head - Modifier	modifier + head	head + modifier	head + modifier	head + modifier
Branching direction	left branching	right branching	right branching	right branching
Morphology				
Agglutinative vs Flective (Synthetic) languages	Agglutinative	Flective	Flective	Flective

Table 2. Demographics, Intelligence, and Language background per Language group

	Albanian Monolinguals		**Serbian Monolinguals**		**Turkish-Albanian Bilinguals**		**Albanian-Greek Bilinguals**		**Albanian-Serbian Bilinguals**		**Bosnian-Albanian Bilinguals**			
	N = 54		*N* = 51		*N* = 50		*N* = 50		*N* = 51		*N* = 50			
	M (SD)	*Range*	*M (SD)*	*Range*	*M (SD)*	*Range*	*M (SD)*	*Range*	*M (SD)*	*Range*	*M (SD)*	*Range*	*F*	*p*
Age	25.31 (5.48)	18-42	24.03 (7.11)	18-50	24.46 (6.67)	18-45	23.86 (6.20)	18-42	23.84 (7.27)	18-46	24.80 (5.32)	18-42	.443	.818
Bilingualism onset	--	--	--	--	3.70 ^{a} (1.75)	1-7	6.20^{b} (4.25)	1-19	6.98 ^{b} (2.50)	1-14	4.00 ^{a} (1.77)	1-8	17.53	.000
Raven's	48.81 ^{a} (1.89)	18-42	51.88 ^{b} (4.52)	41-60	49.12 ^{a} (3.77)	41-58	48.06 ^{a} (3.27)	42-57	51.98 ^{b} (4.05)	43-59	50.02 (2.09)	46-57	11.79	.000
Vocabulary L1	56.09 (2.42)	49-66	62.84 (2.41)	56-66	57.34 (5.95)	45-66	53.66 (4.61)	42-64	56.49 (5.62)	43-66	55.68 (3.88)	46-65	--	--
Vocabulary L2	--	--	--	--	56.13 (6.69)	26-65	55.72 (4.72)	46-66	52.64 (8.69)	32-66	56.12 (5.45)	38-63	1.96	.120
Education L1-L2	--	--	--	--	10.72^{a} (3.75)	3-19	10.12^{b} (4.80)	0-16	4.08 ^{a} (5.75)	0-18	6.62 ^{a} (4.43)	0-19	21.77	.000
BSWQ – Total	--	--	--	--	30.44 (5.77)	19-43	33.18 ^{a} (6.29)	18-45	29.62 ^{b} (6.16)	17-48	30.94 (5.92)	17-45	3.18	.025
Integration strategy (%)	70		90		60		61		--		--			
Assimilation strategy (%)	12		8		16		24		--		--			
Separation strategy (%)	14		2		14		10		--		--			
													χ^2	*p*
SES level	50.0% (low) 42.6% (middle) 7.4% (high)		72.5% (low) 25.5% (middle) 2.0% (high)		60.0% (low) 32.0% (middle) 8.0% (high)		68.0% (low) 32.0% (middle) --		74.5% (low) 23.5% (middle) 2.0% (high)		42.0% (low) 20.0 % (middle) 18 % (high)		26.28	.001

Note. Means denoted by different letters are significantly different from each other (p < .05); Education L1-L2 = absolute difference in years.

Table 3. Mean Accurate Reaction Times (RTs) and Mean Accuracy Rates (ACC) for Neutral, Congruent and Incongruent trials, in the Simon Task

	Neutral trials		**Congruent trials**		**Incongruent trials**		**Simon effect**
	RTs	*ACC*	*RTs*	*ACC*	*RTs*	*ACC*	
Acculturation strategy analysis							
Bicultural bilinguals (N=40)	441.55 (63.40)	.95 (.05)	450.16 (75.35)	.97 (.04)	484.47 (77.34)	.93 (.07)	34.31
Monocultural bilinguals (N=45)	468.99 (94.30)	.95 (.05)	470.31 (93.63)	.96 (.04)	496.15 (94.56)	.92 (.08)	25.83
Monolinguals (N=49)	456.91 (106.72)	.96 (.03)	468.09 (115.05)	.96 (.03)	489.88 (111.74)	.95 (.04)	21.79
Linguistic distance analysis							
Turkish-Albanian bilinguals (N=37)	452.63 (71.86)	.93 (.05)	451.08 (69.27)	.96 (.05)	492.75 (67.66)	.91 (.08)	41.67
Bosnian-Albanian bilinguals (N=44)	447.21 (58.42)	.96 (.02)	458.05 (65.66)	.96 (.03)	470.94 (74.10)	.95 (.04)	12.88
Albanian-Greek bilinguals (N=38)	422.62 (69.43)	.93 (05)	421.12 (70.12)	.95 (.05)	460.94 (67.66)	.88 (.09)	40.01
Albanian monolinguals (N=52)	496.44 (104.48)	.95 (03)	501.77 (110.01)	.96 (.03)	520.01 (114.48)	.95 (.04)	18.22
Cluster analysis: Bilingual profile							
Balanced bilinguals (N=105)	451.23 (78.76)	.94 (.04)	458.05 (84.75)	.96 (.04)	485.83 (88.16)	.92 (.08)	27.77
Unbalanced bilinguals (N=62)	490.87 (108.90)	.96 (.04)	490.49 (109.90)	.98 (.03)	524.04 (106.66)	.94 (.06)	33.54
Monolinguals (N=102)	454.67 (92.52)	.96 (.03)	461.27 (95.99)	.97 (.03)	486.51 (98.70)	.94 (.04)	25.24

Note: Standard deviations are given in parentheses.

Table 4. Mean Accurate Reaction Times (RTs) and Mean Accuracy Rates (ACC) for Switch, Repeat and Pure Trials, in the Colour-Shape Switching *Task*

	Mixed blocks				**Pure blocks**		**Switching cost**	**Mixing cost**
	Switch trials		**Repeat trials**					
	RTs	*ACC*	*RTs*	*ACC*	*RTs*	*ACC*		
Acculturation strategy analysis								
Bicultural bilinguals (N=44)	773.12 (235.32)	.88 (.06)	637.68 (174.99)	.94 (.05)	485.26 (85.56)	.95 (.04)	135.44	152.42
Monocultural bilinguals (N=48)	849.79 (280.11)	.88 (.08)	692.45 (220.94)	.91 (.06)	481.52 (92.13)	.93 (.04)	157.33	210.93
Monolinguals (N=48)	810.57 (231.81)	.91 (.06)	644.02 (182.15)	.94 (.05)	503.50 (114.29)	.96 (.02)	166.55	140.52
Linguistic distance analysis								
Turkish-Albanian bilinguals (N=40)	875.46 (290.95)	.84 (.07)	665.17 (186.56)	.89 (.06)	452.35 (71.25)	.93 (.04)	199.11	199.96
Bosnian-Albanian bilinguals (N=47)	648.55 (197.78)	.90 (.04)	522.91 (131.57)	.95 (.02)	453.04 (59.85)	.95 (.02)	128.61	83.44
Albanian-Greek bilinguals (N=39)	883.55 (266.04)	.84 (.07)	694.74 (205.20)	.90 (.06)	456.70 (90.28)	.92 (.05)	191.10	241.21
Albanian monolinguals (N=54)	885.99 (231.04)	.89 (.05)	709.12 (204.59)	.93 (.04)	566.09 (20.29)	.94 (.02)	176.77	143.02
Cluster analysis: Bilingual profile								
Balanced bilinguals (N=114)	787.62 (266.15)	.88 (.06)	625.48 (198.49)	.93 (.05)	463.25 (80.83)	.94 (.04)	162.13	162.23
Unbalanced bilinguals (N=63)	905.93 (256.56)	.90 (.06)	767.65 (235.55)	.93 (.06)	524.26 (108.55)	.95 (.03)	138.28	243.38
Monolinguals (N=102)	844.81 (237.88)	.91 (.05)	671.13 (182.53)	.94 (.05)	513.25 (110.50)	.95 (.02)	173.68	157.88

Note: Standard deviations are given in parentheses.

Table 5. Mean Accuracy Rates for AX, AY, BX and BY trials, in the AX Continuous Performance Task (AX-CPT)

	AX trials	**AY trials**	**BX trials**	**BY trials**	**Proactive strategy score**
Acculturation strategy analysis					
Bicultural bilinguals (N=45)	.90 (.10)	.62 (.23)	.76 (.19)	.91 (.12)	.13
Monocultural bilinguals (N=52)	.88 (.13)	.62 (.23)	.73 (.24)	.90 (.11)	.11
Monolinguals (N=50)	.93 (.07)	.75 (.18)	.81 (.17)	.95 (.08)	.06
Linguistic distance analysis					
Turkish-Albanian bilinguals (N=49)	.84 (.07)	.41 (.19)	.84 (.19)	.93 (.11)	.43
Bosnian-Albanian bilinguals (N=47)	.94 (.07)	.66 (.18)	.80 (.15)	.90 (.11)	.13
Albanian-Greek bilinguals (N=41)	.78 (.16)	.59 (.23)	.55 (.28)	.80 (.14)	-.04
Albanian monolinguals (N=52)	.91 (.09)	.75 (.18)	.76 (.20)	.93 (.11)	.01
Cluster analysis: Bilingual profile					
Balanced bilinguals (N=121)	.87 (.12)	.56 (.22)	.74 (.23)	.89 (.13)	.17
Unbalanced bilinguals (N=68)	.91 (.10)	.69 (.22)	.74 (.23)	.92 (.10)	.05
Monolinguals (N=100)	.92 (.07)	.73 (.17)	.78 (.19)	.93 (.10)	.05

Note: Standard deviations are given in parentheses.