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REASONING ABOUT SOCIAL CATEGORIES

An Investigation of Multilinguals' versus Monolinguals' Reasoning about Social Categories

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Abstract

Young children view social categories as stable, independent identities – known as “essentialist” beliefs. Knowledge learned later in development makes individuals aware of identities that contrast earlier essentialist identities, such as multilingual identities. Do adults with multilingual identities hold more flexible views of social category identities as compared to monolingual peers? In a computer-based task, participants were instructed to deem statements that appeared on screen true or false as quickly and accurately as they can. A statement was considered true based on its truth-value according to learned knowledge. Following completion of the computer-based task, participants answered a written questionnaire to ascertain more details of their language proficiencies. It is predicted that multilinguals will show greater cognitive flexibility in this task, as compared to monolinguals, based on previous research showing that multilinguals have performed better as compared to monolinguals on tasks related to executive functioning. In this experiment ($n = 76$), we find no significant differences in the response time or percent correct in multilinguals versus monolinguals. It is possible no difference between language status groups was found because there was no meaningful difference in the non-English language proficiencies between the two groups. Future research should establish more clearly defined parameters to differentiate between multilinguals and monolinguals.

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An Investigation of Multilinguals' versus Monolinguals' Reasoning about Social Categories

America is becoming increasingly more diverse, with more individuals identifying as multiracial, multilingual, and multiethnic. In 2015, one in seven American infants were multiracial or multiethnic, as compared to one in 31 in 1980 (Livingston & Brown, 2017). Historically, the 1900s were considered a low point in America's linguistic heritage, though statistics describing America's rich linguistic landscape today are on par with the linguistic diversity brought about by the large numbers of immigrants in the late 1800s (Rumbaut & Massey, 2013). A reflection of America's continual linguistic diversity, nearly 16% of adult Americans were multilingual and around 25% of American children were Spanish speakers in 2014 (Murphey, Guzman & Torres, 2014). In contrast to the linguistic landscape of the United States of the pre-World War II period, Spanish is currently the most commonly spoken language after English. The US Census of 2013 found that around 20% of Americans speak a non-English language at home, with 10% of those families speaking Spanish (Rumbaut & Massey, 2013). By 2020, there will be more preschoolers who are bilingual or multilingual than monolingual in America (Maxwell, 2013). The fact that younger generations will usher in a new dynamic of an increasingly multilingual mainstream American culture highlights the need for more research comparing monolinguals to multilinguals from a cognitive perspective. The current experiment seeks to investigate, do multilinguals reason differently about social categories as compared to monolinguals?

Research has indicated that at least for cognitive processes, multilinguals may have an advantage as compared to monolinguals, and that there may even be discrepancies in cognition

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between those who learn multiple languages simultaneously in early childhood and those who learn second languages later on in development (Dopke, 1997; Li, Legault, & Litcofsky, 2014). For decades, researchers across disciplines along with the general public have considered multilingualism a significant cognitive advantage (Abutalebi & Clahsen, 2015). From Sapir and Whorf's theory that language shapes thought, to recent media outlets reporting that multilinguals have bigger brains, there is no shortage of public interest and research into language and cognition (Kay & Kempton, 1984; Abutalebi & Clahsen, 2015). While the Sapir-Whorfian hypothesis has been and will continue to be contested, research has shown that in multilinguals, language certainly does impact the way they think (Hunt & Agnoli, 1991). Because multilinguals must presumably alter their cognition to use different syntax and lexicon between languages, it is not unlikely there are differences in the daily cognitive functioning of multilinguals as compared to monolinguals (Hunt & Agnoli, 1991). Such cognitive functioning areas where multilinguals differ from monolinguals include executive function, attentional control, inhibitory control, and task-switching (Miyake, et al., 2000).

Much of the literature comparing multilinguals to monolinguals from a cognitive lens is based on research regarding executive functioning (Bialystok & Craik, 2010). The executive function system is so widely studied because it is a development milestone in early childhood, and its components include cognitive capabilities that are the first to decline in the elderly (Bialystok & Craik, 2010). While the definition of executive functioning varies across the literature, the most referenced definition identifies inhibition, updating and switching as the core components of executive control (Miyake, et al., 2000). Updating is the continuous monitoring and responsive addition or removal of items stored in short-term memory (Miyake, et al., 2000).

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Inhibition is the ability to prioritize one response over another given the context (Miyake, et al., 2000). Finally, shifting refers to shifting attention between tasks (Miyake, et al., 2000).

Though the bulk of research related to multilinguals and executive control is concentrated on early childhood and aging, middle-aged multilingual adults have shown faster response times on tasks related to attentional control (Bialystok & Craik, 2010). Known as the Stroop task, this assessment of cognition is designed to evaluate how an individual's reaction time may be impacted by interference, that is to say, conflicting stimuli (MacLeod, 1992). While there are some differences in how the task is implemented in an experimental setting, typically an individual is instructed to respond to the color of the letters of the word, rather than the color the word is spelled out to represent (MacLeod, 1992). The difficulty of this task, and source of interference, is the difference between what the word is spelling out and the color of the letters of the word (MacLeod, 1992). In the study using such tools as the Stroop task, multilinguals were found to have an attentional edge over monolinguals in their ability to respond to the relevant details of a stimulus and inhibit the response to distracting aspects of the stimulus (Bialystok & Craik, 2010). Interestingly, this study found that multilinguals have an advantage in executive function, but not verbal proficiency or lexicon (Bialystok & Craik, 2010).

In one study examining executive functioning of multilinguals versus monolinguals, researchers identified executive control as response suppression, inhibitory control, and cognitive flexibility (Bialystok & Viswanathan, 2009). Multilingual 8-year olds enrolled in the study had shorter response times in conditions of inhibitory control and cognitive flexibility, with no major differences in tasks unrelated to executive control or tasks related to response suppression (Bialystok & Viswanathan, 2009). For example, children were faster to change the object of their direction on a trail-switching task, which involves making a "trail" connecting various shapes in

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a visual representation in a particular sequence (Bialystok & Viswanathan, 2009; Salthouse, 2011). This task is an assessment tool to evaluate cognitive speed and fluidity and has also been referred to as a “trail-making task” (Salthouse, 2011). Multilinguals, however, did not show a similar difference when engaging in a task that tested response suppression (Bialystok & Viswanathan, 2009). As with much of the literature related to multilinguals, Bialystok and Viswanathan acknowledge that it is difficult to isolate executive functioning effects of being multilingual, versus other components of what it means to be multilingual. For instance, multilinguals may have better inhibitory control because they must code-switch depending on context, because they learned two languages simultaneously and have to selectively attend to a variety of auditory input, or because of the fluid cultural identity that comes with being multilingual (and multicultural) (Bialystok & Viswanathan, 2009). Given that this study involved multilingual children in both India and Canada, the cognitive advantages found in the multilingual participants are generalizable across language use and cultural differences (Bialystok & Viswanathan, 2009). The authors do note that it is difficult to make definitive conclusions about multilinguals generally when multilingual groups vary greatly in terms of language use, social class or immigrant status, and education (Bialystok & Viswanathan, 2009).

Executive function and inhibitory control are also important components of cognition to consider because of their relation to theory of mind development (Goetz, 2003). Theory of mind is a person’s ability to attribute mental states (i.e. thoughts, feelings) to their own self and others, which can be difficult for young children given their egocentrism (Goetz, 2003). Inhibitory control is a necessary first step for children to be able to distinguish their own thoughts and feelings from those of others (Goetz, 2003). Goetz found that multilingual 3 and 4 year olds performed better than their same-age monolingual peers on theory of mind-related tasks, such as

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a false belief task (Goetz, 2003). Goetz proposes several possible rationales for why multilinguals may have an advantage on false belief tasks. A false belief task is based on the idea that an individual, typically a child, may hold an idea that is at odds with reality (Goetz, 2003). Multilingual children may have greater metalinguistic awareness, allowing a more complex understanding of how to represent language (Goetz, 2003). In speaking different languages, multilingual children must be able to consider the context as well as the language the person they are interacting with uses giving them more practice in considering the perspective of another person (Goetz, 2003). Multilingual children may also have a theory of mind advantage simply due to the fact that they already have an advantage over monolingual peers in the arena of executive function (Goetz, 2003).

In a study examining executive function in preschoolers, multilingual children showed an advantage in inhibitory control and flexible switching (based on the rules being changed) in a card-based task as compared to their monolingual peers (Nayak, 2017). This study also found that a multilingual advantage in the preschool years is related to socio-emotional context (this study in particular looked at hot cognitive flexibility and hot inhibition) and the feedback they are given on the task (Nayak, 2017). Hot cognitive flexibility and hot inhibition refers to the fact that stimuli that may have had an affective association were used (Nayak, 2017). In another study focusing on the preschool years, researchers found a longitudinal relation between executive function and early multilingualism (Crivello, et al., 2015). Executive function was assessed using a variety of tasks, focusing on conflict, delay and working memory (Crivello, et al., 2015). Researchers found that with a growth in multilingual proficiency over 7 months, as quantified by an increased number of translation equivalents (i.e. *cat* in English, *gato* in Spanish), multilingual toddlers did see greater executive function gains over their monolingual

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peers (Crivello, et al., 2015). The correlation between increased translation equivalents and executive function can be explained by situations that provide more opportunities for a child to inhibit one language when using another (Crivello, et al., 2015). Lexical growth did not correlate with similar benefits in executive function, which indicates that a monolingual child with an extensive lexicon would not exhibit the same advantage (Crivello, et al., 2015). This study also upholds previous Bialystok research that the multilingual advantage is present regardless of the socio-economic status variable (Crivello, et al., 2015). This is important given the range of socio-economic status, parental education level, and related factors in multilingual populations. In this study, researchers chose to assess both conflict inhibition and response suppression because previous studies have found that not all assessments of inhibition correlate with a multilingual advantage (Crivello, et al., 2015).

As the present study focuses on an undergraduate sample, it is valuable to note that in a study comparing multilingual and monolingual Iranian university students, multilingual students showed an executive function advantage (Kazemeini & Fadardi, 2016). Using such assessment tools as the Backward Digit Span Test (a subscale of the Wechsler Adult Intelligence Scale) and the Stroop Color-Word Test, a multilingual advantage was found (Kazemeini & Fadardi, 2016). Multilinguals were less affected in the incongruent Stroop task and better at suppressing distracting, irrelevant information (Kazemeini & Fadardi, 2016). The researchers attribute this advantage as supportive of previous literature stating multilinguals have a cognitive advantage due to better inhibitory control as compared to monolinguals (Kazemeini & Fadardi, 2016). This study also replicated previous research indicating that multilinguals have a superior working memory, as measured by the forward digit span (Kazemeini & Fadardi, 2016). A forward digit

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span is a task to assess short-term memory in which participants may be asked to recall the sequence of a particular set of numbers previously shown to them (Kazemeini & Fadardi, 2016).

In a study focusing on young adults, participants who were monolingual or multilingual and who did or did not have significant video game playing experience completed two Simon tasks in which participants had to press a particular computer key based on the stimulus on the computer screen (Bialystok, 2006). In this task, stimuli containing both position and response information are presented with a rule that requires participants to ignore the position and respond only to a relevant target feature (for example, if blue, press the left key; if yellow, press the right key). When the stimulus appears on the same display side as the correct response key, both position and response information converge (Bialystok, 2006). When the position conflicts with the correct response, more effortful processing is required to resist the tendency to respond to the position cue (Bialystok, 2006). As in previous studies, this study found that multilingual participants were able to ignore misleading information and stay focused on the relevant aspects of the task (Bialystok, 2006). The Simon effect is so named because there is a difference of around 20-30 second in responding to convergent trials, where position and response information are congruent, to incongruent trials, where position and response information are in contrast (Bialystok, 2006). Ultimately in this Simon task study, the advantages of being a seasoned video gamer were greater than the advantages of being multilingual, reflecting a limit to the cognitive advantage of multilinguals versus monolinguals (Bialystok, 2006).

A cognitive advantage in multilingual college students was also found in the domain of task-switching (Prior & MacWhinney, 2010). Researchers found multilinguals had reduced switching costs, meaning that multilingual participants could more easily complete a task based

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on a prompt and could overcome residual interference from a previous task (Prior & MacWhinney, 2010). A multilingual advantage in task switching is also attributed to multilinguals' advantage in inhibitory control (Prior & MacWhinney, 2010). Prior and MacWhinney mention an important obstacle in making conclusions about multilingual cognitive advantages: there is a lack of unanimity in defining the components of executive function, and the study designs in the literature vary widely.

Another subset of research examining the multilingual advantage in executive function domains center on conflict resolution tasks (Bialystok, 2010). In two experiments, multilinguals had an overall advantage in reaction times in the flanker task, which was used as a tool to assess conflict resolution and conflict monitoring (Costa, Hernandez, Costa-Faidella, and Sebastian-Galles, 2009). In the flanker task, participants must focus on a particular pertinent stimulus that is “flanked” by irrelevant stimuli that may distract them (Costa, 2009). Similar cognitive advantages related to shifting ability and inhibitory control have been found with preschoolers, as assessed through a card sort task and the Simon task (Mehrani & Zabihi, 2017). Mehrani and Zabihi's work is also valuable because it replicates results found regarding a cognitive advantage in multilingual preschoolers in the Middle East, where cultural and sociolinguistic norms vary as compared to North America.

The literature discussed shows that there are significant findings regarding a multilingual advantage in cognition, specifically within areas related to executive functioning (Bialystok, 2006). A variety of assessment tools, such as the Stroop task and Simon task, have shown that multilinguals are stronger in certain domains of Executive Functioning such as shifting, updating, and inhibition (Bialystok, 2006). The literature supports an advantage in executive

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functioning for multilinguals from an early age because of the cognitive implications of using a certain language in a certain context and altering language use depending on environment (Goetz, 2003). This then would require the multilingual individual to understand Theory of Mind from an early age, in order to anticipate an individual's chosen language in conversation and to inhibit the tendency to speak in a language accordingly (Bialystok, 2006). While much of the literature focuses on youth, a multilingual advantage has been found across ages, languages, and socio-economic statuses (Crivello, et al., 2015; Kazemeini & Fadardi, 2016).

While governmental agencies methodically gather statistics related to languages spoken within the American population, it is difficult to find rigorous research examining the connection between linguistic diversity and ideas about social categories and group membership (Schildkraut, 2001). Language is not as thoroughly researched from a cognitive development lens as race or gender, perhaps because language is more nebulous. It is also possible there is a lack of researchers who are fluent in non-English languages widely spoken in the United States, therefore making conducting research with non-English speaking participants less approachable (Toppelberg, 2013). A person may only speak a given language in a certain context and given the homogenous linguistic standard of America in the twentieth century, often multilinguals speak exclusively English in public, such as the workplace or school, and a native language at home (Toppelberg & Collins, 2010). Linguistic identity may be more imprecise to study when compared to other social category memberships, such as gender or race, because it is harder to define (Carter, 2018). One person may speak only Spanish until they start school and eventually lose all proficiency in Spanish, while another person may grow up speaking English in the home and learn Spanish in school, and both may be considered bilingual. It is also important to note that even within the larger social category of being multilingual, it is possible there are different

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confounds stemming from a language's connection with a certain race, such as stereotypes that all French Creole speakers are black or all German speakers are white.

Category membership refers to the idea that humans group objects and organisms based on their similarities, while essentialism refers to the idea that from childhood, humans have innate ideas of fixed social category discreteness (Gelman, 2004). That is to say, there is a perception from early in life that there is something intrinsic about an individual that leads to their category membership. Essentialism implies that there are mutually exclusive, fixed boundaries of social categories, and the idea that social category membership is a constant across the lifespan (Gelman, 2004). In addition to the need for more research on how linguistic diversity is related to essentialist beliefs from a cognitive perspective, a deeper understanding of how individuals view category membership across the lifespan with reference to linguistic identity may be especially informative in leading conversations about such topics as, what does it mean to be multilingual in America?

Essentialism research has found that gender identity, language, and race, respectively, are thought of as fixed, unchanging categories by children (Gelman, 2004). Additionally, research has shown that to children, these three social category questions of gender, language, and race are considered fixed across the lifespan. Similar to essentialist beliefs in race and gender categories, children report that a person will speak the same language across the lifespan (Hirschfeld & Gelman, 1997; Kinzler & Dautel, 2012). Children attribute language differences to race, and there seems to be an inherent correlation in preschoolers that minority race individuals and people wearing unfamiliar clothing more like to speak a non-English language (Hirschfeld & Gelman, 1997). Hirschfeld and Gelman also concluded that children view social differences as linguistic differences.

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Further examining the relationship between essentialist views of language and race, five and six-year olds were found to demonstrate an intuitive belief in greater stability when it comes to the language a person speaks as opposed to the race of a person (Kinzler & Dautel, 2012). This finding indicates young children believe language spoken is more likely to remain consistent across lifespan than one's racial category. Understanding the cognitive development patterns behind social category perspective is important given that implicit negative attitudes remain relatively stable across the lifespan, and these negative attitudes do indeed manifest themselves in behavior (Baron & Banaji, 2006). One should consider what essentialist ideas about social categories a child may hold, because negative ideas about social groups, that later manifest themselves as bias and discrimination, form relatively early in life (Baron & Banaji, 2006)

While there is a wealth of literature related to the cognitive advantage of multilinguals and essentialist views and social categories, such bodies of research exist in isolated spheres. Empirical research is needed to delve more deeply into the topic of how cognitive development may inform ideas of how linguistic identity is perceived. Such research may better inform educators, policy makers and other advocates for multilinguals (particularly immigrants and/or other minority groups) about the developmental biases they may need to consider to ensure multilinguals are not penalized for their linguistic identity, and that such identity is supported and celebrated in mainstream American society (Toppelberg & Collins, 2010). This is especially important given the increasingly hostile attitude Americans (typically American monolinguals) take towards multilingual Americans. To discover more about the cognition related to monolinguals and multilinguals reasoning about social categories, this thesis project seeks to

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investigate, are ideas of the essentialism of the social category of linguistic identity overturned with age, or simply repressed?

This current study is based on previous research examining learned knowledge about social categories. In previous research in this area, participants completed a computer-based task similar to that of the current study in which they had to make truth-value judgments regarding a statement related to social categories. Participants in this and previous studies completed a reasoning task modeled after Shtulman and Valcarcel (2012). In the first round of the computer-based task, participants are instructed to make a true or false judgment of the statement on the screen as fast as they can by pressing the corresponding computer key. In the second round, the difference is that participants are instructed to take their time in forming a response. Critically, half of the statements were consistently true or false across essentialist and learned knowledge, while the other half were inconsistent. An example of an inconsistent statement in the language domain is “A child English-speaker can’t grow up to be an adult English-speaker”. An example of a consistent statement in the language domain is “A child English-speaker can grow up to be an adult English-speaker”. (Lange & Muentener, 2019)

Previous social knowledge research found a consistency effect, meaning participants were quicker and more accurate when making a truth-value judgment about a statement that was consistent with both essentialist ideas and learned knowledge (Lange & Muentener, 2019). In a variation of a social knowledge experiment that included a priming task, participants who first reflected on identity showed decreased conflict in their reaction time in responding to statements (Lange & Muentener, 2019).

Because multilingual individuals must use some language control cognition to choose what language to engage in, one may predict that multilinguals have greater cognitive control

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than monolinguals and are better able to use inhibitory control to overcome intuitive ideas regarding social categories (Poarch & van Hell, 2012). The suppression of the non-target language and the activation of the target language requires a higher degree of attentional control in multilinguals that may not be as developed as that control of monolinguals (Poarch & van Hell, 2012). It is predicted that multilinguals are better able to overcome essentialist attitudes when completing a true-false task focused on social categories because of their superior inhibitory control.

Method

Participants. Seventy-six college undergraduates (46 female) participated in this experiment. Thirty-six participants were in the monolingual group and 40 participants were in the multilingual group. Eighteen monolingual participants and 28 multilingual participants self-identified as female. Participants were recruited from Tufts University introductory psychology courses and earned course credit for their participation. While participants were classified initially as monolingual or multilingual based on a pre-screen on the participant recruitment website, 7 participants who self-identified as monolingual were reassigned to the multilingual group based on their questionnaire responses. Four individuals who self-identified as multilingual on the pre-screen were reassigned as monolinguals based on their questionnaire responses.

Materials. The stimuli for this experiment included a series of 48 statements and a questionnaire regarding the participant's linguistic capabilities. In the statements participants presented in the computer task, half of the statements were consistent across essentialist intuitions and learned knowledge, and half of the statements were inconsistent across essentialist intuitions and learned knowledge. One quarter of statements were true in the sense of both

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essentialist and learned knowledge, a quarter were false according to both essentialist and learned ideas, a quarter were false according to essentialist intuition but true according to learned knowledge, and finally, a quarter were true based on essentialist ideas but false according to learned knowledge. The statements, found in Table 1, focused on domains of race, gender, and spoken language. These statements were chosen based on their membership to domains that may lead to conflict between essentialist ideas and learned social knowledge. (Lange & Muentener, 2019)

Eight statements related to race were based on the discreteness of racial categories (*Race-discreteness*), addressing whether a participant could identify with multiple racial identities. Eight statements related to gender were based on the stability of gender identity (*Gender-stability*), addressing whether an individual's gender identity could change with time. Eight statements related to language focused on both the discreteness and stability of spoken language (*Language-discreteness, Language-stability*), respectively addressing whether an individual could speak multiple languages and whether an individual's spoken language could change with time.

Statements that focused on stability of racial categories or the discreteness of gender categories were not a part of this experiment, in keeping with previous social knowledge research (Lange & Muentener, 2019). Sixteen statements concerning the stability and discreteness of natural kinds were included in the computer-based task. The statements related to natural categories and the data associated with this portion of the computer-based task are not discussed as they are unrelated to the hypothesis at the center of this study.

Following the computer based true-false tasks, participants completed a questionnaire to determine details regarding their language proficiency beyond the digital participant recruitment

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platform pre-screen. Participants completed as a general pre-screen form, along with other questions relevant to participating in psychology research generally, when creating an online research participant profile. Participants' written responses were coded blindly, without considering participants' data from the computer-based reasoning task. On the first page of the questionnaire, participants wrote their first language, additional languages learned, and percent of time speaking additional languages, if applicable.

Procedure

Participants were led into a quiet room where they sat before a computer with the experiment task automatically programmed. All instructions related to the speeded and unspeeded trials of the computer-based tasks were displayed on the computer screen, with no involvement of the experimenter. Participants were presented with the entire set of statements twice, in two trials. In the speeded trial, participants were instructed to deem the statements as true or false as *quickly* and as *accurately* as possible. After making judgments about all the statements in the first trial, participants completed an unspeeded trial, in which they were instructed to rate the statements as *accurately* as possible, taking as much time as needed. The second trial included the same statements as the first trial, in a newly randomized order. Following the computer based true-false tasks, participants completed a questionnaire to determine details regarding their language proficiency beyond the language status question part of the pre-screen form when creating a research participant profile. Participants' written responses were coded blindly, without considering participants' data from the computer-based reasoning task. On the first page of the questionnaire, participants wrote their first language, additional languages learned, and percent of time speaking additional languages, if applicable.

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Table 1. Domains and Truth-values of Target Statements in Experiment (Lange & Muentener, 2019).

Domain	Essentialist intuitions	Learned knowledge	Statement
Race-discreteness	T	T	An Asian person can have two Asian parents.
			A Black person can have two Black parents.
	F	F	An Asian person can't have two Asian parents.
			A Black person can't have two Black parents.
	F	T	An Asian person can have a White parent.
			A Black person can have a White parent.
	T	F	An Asian person can't have a White parent.
			A Black person can't have a White parent.
Gender-stability	T	T	A little girl can grow up to be a woman.
			A little boy can grow up to be a man.
	F	F	A little girl can't grow up to be a woman.
			A little boy can't grow up to be a man.
	F	T	A little girl can grow up to be a man.
			A little boy can grow up to be a woman.
	T	F	A little girl can't grow up to be a man.
			A little boy can't grow up to be a woman.
Language-discreteness	T	T	A Chinese-speaker can have two Chinese-speaking parents.
			An English-speaker can have two English-speaking parents.
	F	F	A Chinese-speaker can't have two Chinese-speaking parents.
			An English-speaker can't have two English-speaking parents.
	F	T	A Chinese-speaker can have an English-speaking parent.
			An English-speaker can have a Spanish-speaking parent.
	T	F	A Chinese-speaker can't have an English-speaking parent.
			An English-speaker can't have a Spanish-speaking parent.
Language-stability	T	T	A child Spanish-speaker can grow up to be an adult Spanish-speaker.
			A child English-speaker can grow up to be an adult English-speaker.
	F	F	A child Spanish-speaker can't grow up to be an adult Spanish-speaker.
			A child English-speaker can't grow up to be an adult English-speaker.
	F	T	A child Spanish-speaker can grow up to be an adult English-speaker.
			A child English-speaker can grow up to be an adult Chinese-speaker.
	T	F	A child Spanish-speaker can't grow up to be an adult English-speaker.
			A child English-speaker can't grow up to be an adult Chinese-speaker.

Note: Consistent statements had the same truth-values across essentialist intuitions and learned knowledge; inconsistent statements

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had different truth-values across essentialist intuitions and learned knowledge

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Coding

Participants' written post-computer task questionnaire data was coded using the following parameters: (1) 1=monolingual, 2=multilingual and (2) a 1-21 system for each language spoken, in descending order of frequency, 1=English, 2=Spanish, 3=French, 4=Chinese, 5=Korean, 6=German, 7=Hebrew. (3) For items related to proficiency in particular language domains, speaking and understanding, a 0-100 scale with 4 intervals was used: 0-25=0, 26-50=1, 51-75=2, 76-100=3. The scale labeled 0 as "non-native like" and 100 as "native-like". (4) To code the context a particular language was acquired, 1=home, 2=school, 3=community. (5) Age of acquisition was transcribed directly, based on the age, in years, written by the participant. Participants were coded as multilingual if they (1) spoke more than one language, (2) learned the language before age 10, and (3) had an understanding of the language greater than 50 (coded as 2 or above).

Results

Preliminary analyses. Preliminary analyses included (1) removing accidental key-presses (n = 2); (2) removing incorrect responses from the response time dataset (n = 81 for monolinguals, n=95 for multilinguals); (4) removing response time outliers at the individual response level (n = 64 for monolinguals, n= 95 for multilinguals);(5) for each participant, creating a single average response time for each statement type, or imputing the mean response time for that statement type in instances where both response times were missing ; and (6) for each participant, creating a single average accuracy score of either 0%, 50%, or 100% for each statement type by averaging the two accuracy values for each statement type, or imputing the mean accuracy for that statement type in instances where both responses were missing (n = 0).

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Language background questionnaire. Following the computer-based true-false tasks, participants completed a questionnaire to determine details regarding their language proficiency. Although participants self-identified as either monolingual or multilingual in a prescreening survey, participants in both groups reported having experience with multiple languages. The average age of second language acquisition for monolinguals was 8.7 years and for multilinguals was 4.9 years. The most common second language for monolinguals was Spanish (n=9) and for multilinguals was English (n=13). Across both language status groups, school was the most common context for second language acquisition (n=40). Monolinguals had a speaking proficiency average of 0.58 and understanding proficiency of 1.11 for second language. Multilinguals had a speaking proficiency average of 1.9 and understanding proficiency of 2.8 for second language. Seventeen of the 38 total multilinguals identified a third language proficiency, and 5 of the 40 total monolinguals whose questionnaires were coded identified knowledge of a third language. Although multilingual participants reported speaking multiple languages, they reported speaking a single language throughout the majority of their daily life. Multilingual participants reported speaking English around 86% of the time; in contrast, monolingual participants spoke English 96% of the time.

Thus, the questionnaire data indicates that a portion of the monolinguals have some knowledge of a second or, in fewer cases, even a third language. In addition, despite being divided into two groups, the majority of participants in this study, regardless of language status classification, spoke the vast majority of their time in English. The fact that some of the monolinguals may have been better classified as multilinguals, and that much of the time multilinguals speak primarily English, blurs the distinction between these two language status

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groups. We return to the results from the questionnaire, and how they relate to participants' performance on the truth-value reasoning task, in the discussion.

Response time. The first step of analyses examined participants' mean response time to verify the truth-value of statements that were either consistent or inconsistent across essentialist intuitions and learned knowledge. We conducted a 2 (consistency: consistent vs. inconsistent) x 2 (truth-value: true vs. false according to learned knowledge) x 4 (domain: race-discreteness, gender-stability, language-discreteness, language-stability) x 2 (language status: monolingual vs. multilingual) repeated-measures ANOVA on participants' response times to make the truth-value judgments.

This ANOVA showed a main effect of domain ($F(3,225)=115.301, p<.001$). It was expected that participants would take longer to respond to the different domains given the difference in the length of statements. We also found a main effect of truth-value ($F(1,75)=58.793, p<.001$). This difference in response time stems from the fact participants took longer to respond to statements that were false according to learned knowledge. There was a significant interaction between domain, consistency and language status for reaction time ($F(3,73)=3.028, p<.035$). All participants took longer to respond to statements that were false according to learned knowledge. Participants' response time was impacted both by the consistency and truth-value of statements. However, this repeated-measures ANOVA did not show a main effect of consistency, in contrast to previous studies of social knowledge ($F(1,75)=1.756, p<.189$).

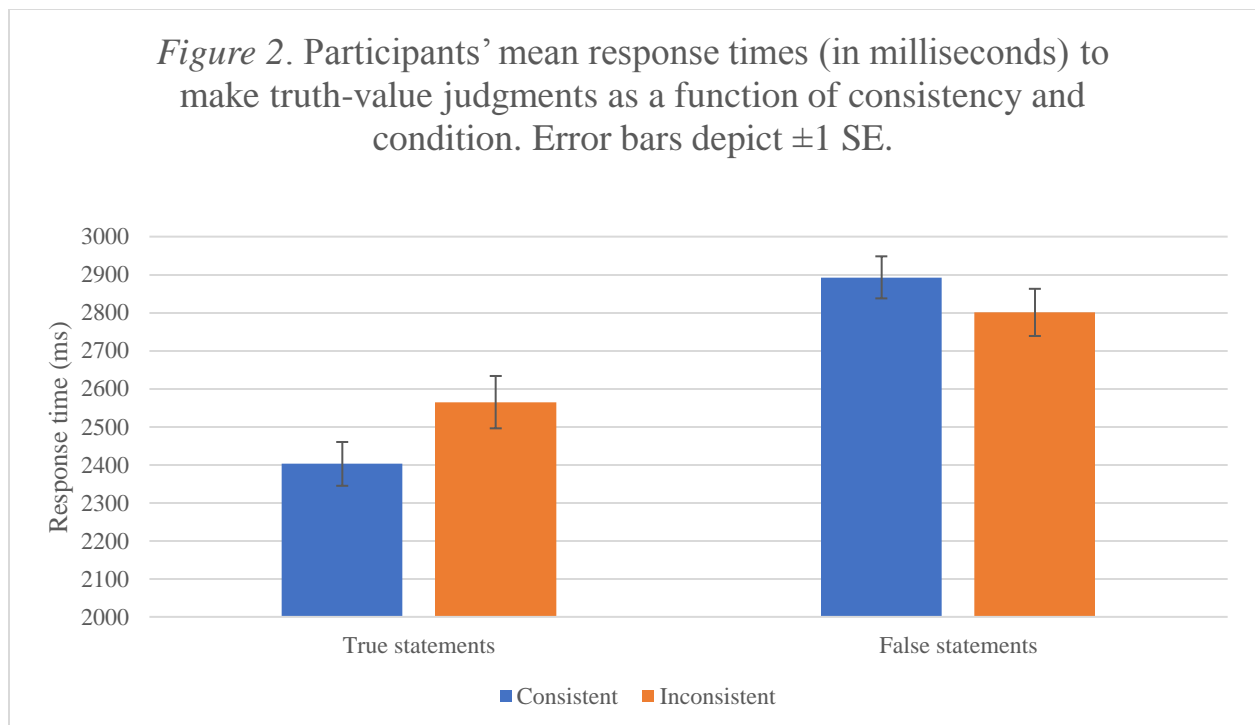
We predicted multilinguals would be faster on inconsistent statements than monolinguals, based on the fact that research has shown multilinguals showed greater cognitive flexibility. This

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prediction was contradicted, as language status did not interact significantly with consistency and truth-value was found between the language status groups ($F(1,75)=1.963, p<.165$). However, across both language status groups the ANOVA did show an interaction between consistency and truth-value ($F(1,75) = 24.207, p<.001$). These findings are depicted in Figure 2. Within true statements, a paired t-test showed that response times were longer for inconsistent statements ($M=2564.7430, SD=556.6650$), $t(76)=-2.910, p<0.005$) as compared to consistent statements ($M=2402.3233, SD=573.6684$). Within false statements, participants' response times were longer for consistent statements ($M=3062.0975, SD=730.3843$) as compared to inconsistent statements ($M=2800.8037, SD=659.1465$), $t(76)=-2.910, p<0.001$. No difference between language groups was found for the interaction for consistency and truth value.

Accuracy. Our second set of analyses focused on the accuracy of participants' truth-value judgments during the first block, the speeded round. We conducted a 2 (consistency: consistent vs. inconsistent) x 2 (truth-value: true vs. false according to learned knowledge) x 4 (domain: race-discreteness, gender-stability, language-discreteness, language-stability) x 2 (language status: monolingual vs. multilingual) repeated-measures ANOVA on participants' mean accuracy scores. This ANOVA showed that there is no significant interaction between consistency and truth value ($F(1,75)=.844, p<.361$). This means that neither monolingual nor multilingual participants showed a higher accuracy rate for statements depending on whether they were true or false according to learned knowledge or if the true-value was analogous with the essentialist idea associated with the statement.

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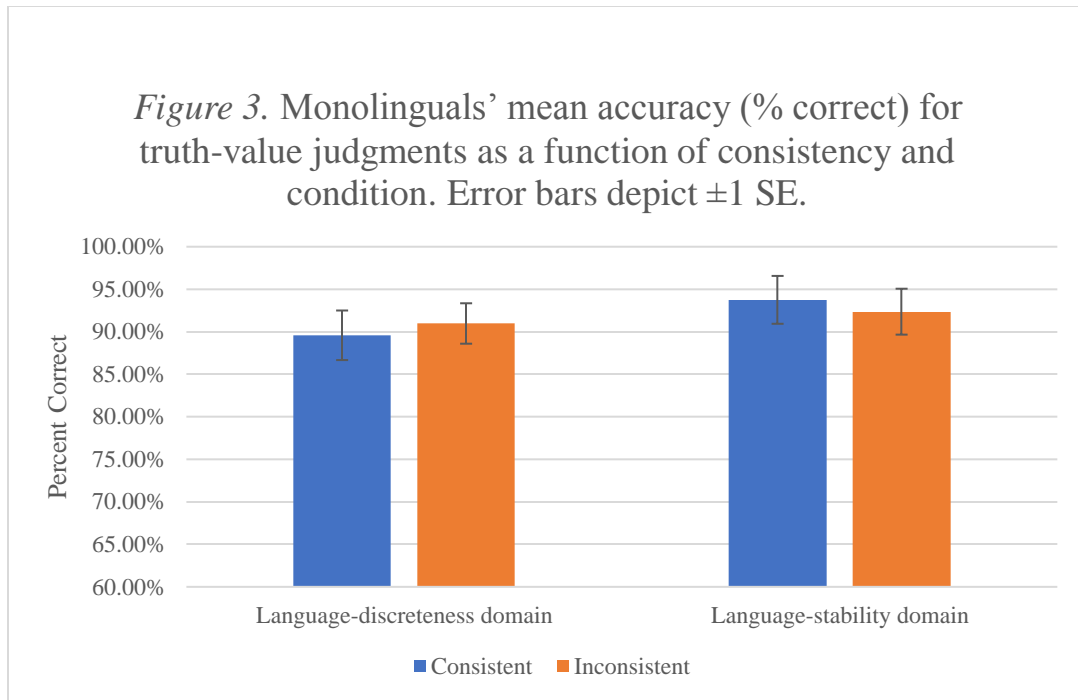


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There was, however, a significant interaction between domain, consistency, and language status for accuracy, ($F(1,75)=5.111, p<.027$). This interaction reflected the fact that although monolinguals did not show an effect of consistency, ($F(1,35)=.192, p<.901$), for multilinguals there was an interaction between consistency and language domain items ($F(3,120)=9.319, p<.001$).

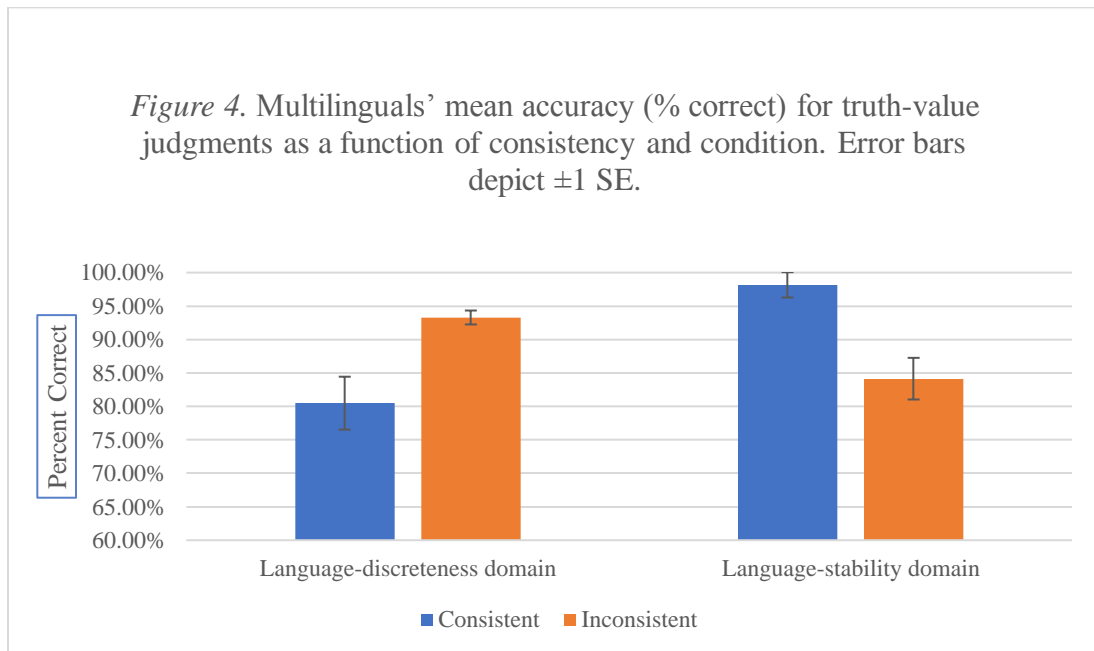
Further t-test comparison did show that there were significant differences in accuracy for language stability and language discreteness items in the multilingual group as compared to the monolingual group. Figure 4 shows that there was a significantly higher percent correct for consistent language stability items ($M=98.17\%$, $SD=65.91\%$) as compared to inconsistent language stability items ($M=84.15\%$, $SD=26.08\%$), $t(40)=3.501, p<0.001$. There was also significantly lower percent correct for consistent language discreteness items ($M=80.49\%$, $SD=34.69\%$) as compared to inconsistent language discreteness items ($M=93.29\%$, $SD=13.72\%$), $t(40)=-2.766, p<0.009$. Monolinguals, in contrast, showed the greatest accuracy in consistent language stability items ($M=93.75\%$, $SD=19.25\%$). Monolinguals scored relatively high also for inconsistent language stability items ($M=92.36\%$, $SD=22.22\%$), consistent language discreteness items ($M=89.58\%$, $SD=21.86\%$), and inconsistent language discreteness items ($M=90.97\%$, $SD=21.67\%$), as shown in Figure 3. This indicates that across statements related to language stability and discreteness, multilinguals showed less accuracy than monolinguals.

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Figure 4. Multilinguals' mean accuracy (% correct) for truth-value judgments as a function of consistency and condition. Error bars depict ± 1 SE.



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Discussion

This research sought to expand upon previous studies examining essentialism and social categories, with a particular focus on how monolinguals versus multilinguals reason about social categories. Thirty-six monolingual participants and 40 multilingual participants were recruited from the Tufts undergraduate community. Participants completed a computer-based true-false task based on statements that were true or false based on essentialist ideas and/or true and false based on learned social knowledge. After the computer-based portion, participants then completed a brief paper questionnaire inquiring more about their language status. Analysis showed multilingual participants were less accurate at making judgments about essentialism-inconsistent statements compared to essentialism-consistent statements evaluated by monolingual peers. This effect was largely due to statements related to language stability and discreteness. An interaction between consistency, truth-value, and domain was found across all participants for reaction time. This indicates that regardless of language status, false consistent statements seemed to pose the most challenge to participants making a truth value judgment. An example of a false consistent statement might be “A Chinese-speaker can't have two Chinese-speaking parents”; this is false according to both essentialist and learned social knowledge. This is dissimilar from previous results of social knowledge experiments, where participants took longer on statements that posed a conflict between essentialist and learned knowledge, that is to say, on essentialist-inconsistent statements (Lange & Muentener, 2019).

The results of this social knowledge experiment are quite at odds with the body of literature of previous social knowledge research (Lange & Muentener, 2019). Though the participants in this study were broken down into monolinguals and multilinguals, the group as a

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whole did not replicate previous findings in social knowledge experiments within the Tufts community. A key difference between this and previous studies of social knowledge in this setting is the majority of participants in this study were multilingual, while it is assumed the majority of participants in other social knowledge studies were monolingual. In the present study, reaction times were longer for false consistent statements across all domains and language status groups. In previous studies related to social knowledge, participants took longer to respond to inconsistent statements generally (Lange & Muentener, 2019). In addition, the current investigation only analyzed response time and accuracy related to speeded trials of the computer task. It is possible if both the speeded and unspeeded trials had been examined, an effect that replicated previous research might exist.

Beyond failing to replicate previous social knowledge experiments, this study also failed to replicate research showing multilinguals generally show greater cognitive flexibility than monolinguals (Poarch & van Hell, 2012). It should be noted findings cannot be attributed to the wording, length, or syntax of statements relating to essentialist intuition, as these statements have been used in previous research with more robust results (Lange & Muentener, 2019). Given this project's hypothesis that multilinguals would be quicker to override essentialist intuitions regarding social categories, it is interesting that the effect of consistency on accuracy differs by domain for multilinguals but not for monolinguals. Most surprising given the literature that multilinguals may show greater cognitive flexibility, multilinguals showed inaccuracy with language stability statements inconsistent with essentialist attitudes to a greater extent than monolinguals. This finding contradicts previous research that individuals who hold essentialism-inconsistent identities themselves may hold reduced essentialist beliefs (Byers-Heinlein &

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Garcia, 2014; Pauker & Ambady, 2009). There were no significant differences in accuracy between domains within the monolinguals, but there are significant differences in accuracy for both language domains (stability and discreteness) in the multilingual group. The interaction between language status, domain and consistency for multilinguals is driven by responses in language statements, as shown in Figure 4.

Of several possible explanations as to why this study did not lend support to the prediction that multilinguals would have a greater ability to show reduced essentialist thinking in both response time and accuracy when presented with social category statements, there are two primary possible explanations. First, there exists a possibility that there is no meaningful difference between how monolinguals and multilinguals consider social categories. However, given the wealth of literature on the cognitive flexibility advantage associated with multilinguals, it is more likely a difference between the two groups does exist in this realm and there were challenges to showing a difference in this study.

One reason that may explain why the results of this study failed to replicate previous research in this area is because of the lack of distinction between participants who were labeled as monolingual versus persons who were labeled as multilingual. It is not unlikely that some of those sorted into the monolingual category should have met criteria for multilinguals, while the reverse is also true. Many of the monolinguals reported knowledge of a second and in a few cases even a third language, and some monolinguals reported speaking a language other than English for the same amount of time as a multilingual. Of course, some consideration may be given as to the context the non-English language is spoken, and whether that is significant. It is possible that given the environment from which participants were recruited, Tufts University,

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there is a predisposition for there to be fewer “true” monolinguals in the population. Tufts is considered a highly competitive school, and it is likely students attending Tufts have previously attended schools where learning a foreign language was required. Additionally, due to the core curriculum in the Tufts College of Arts and Sciences, it is required students demonstrate knowledge of a non-English language to graduate.

Another potential source of overlap between multilinguals and monolinguals classification in this experiment was the lack of detail inquired about on the questionnaire regarding first language proficiency. The questionnaire did not go into detail when inquiring about the nature of the participant’s first language, with regards to their proficiency in reading and writing. The only detail asked about the first language was the percent of time spoken, with no inquiry into the nature of the acquisition of the first language or the use of first language at present. This makes it difficult to ascertain the relationship between first and subsequent languages, and the details regarding how well a person speaks and understands and the context a person learned their first language. Further research establishing protocol and proper measures of how to qualify multilingual status may make comparisons between multilinguals monolinguals more meaningful.

More research is needed to standardize what qualifies a person to be multilingual in the lens of studies such as this. Generally, multilinguals are sub-categorized further based on whether they learned additional languages earlier or later in life, and in what context the languages were learned (Del Maschio, et al., 2018). It seems previous researchers have not made it a priority to set a rigid definition of what it means to be multilingual given there is such a variation in how an individual may manifest the multilingual identity. Further investigation into

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who meets criteria to be considered a multilingual is needed to better differentiate language status groups in studies such as this. Research into this area may also suggest that language proficiency is a minor part of being a multilingual. It may be worth considering that the cultural identity that comes with multilingual status may be more relevant to cognitive flexibility as compared to code-switching. This research may be particularly pertinent to those such as the multilingual community at Tufts involved in this experiment, where participants spend the majority of their time speaking English on campus, thereby reducing any potential for cognitive advantage due to code-switching.

It is also possible that multilinguals had a unique identity as a result of their language status and the culture language pertains to, but that multilinguals have similar linguistic proficiency to monolinguals in this study and therefore no meaningful cognitive difference between the two groups exists. It may be that multilinguals in this study do not actually engage with a non-English language more than monolinguals in this study, and their proficiency in a non-English language is not any more expert than monolinguals in this study. Especially given the lack of time multilinguals in this study engage in code-switching, this would mean any potential cognitive advantages individuals who spoke multiple languages is not present, or at least greatly reduced. This raises the question for future research: does a language identity equate language status in essentialist tasks such as this?

Though the implications of this study should be considered in light of the fact the results are largely null, one can conclude this study confirms the idea that more research is needed to explore what advantages or disadvantages a multilingual person may have in an essentialist task such as this, and perhaps more basically, how to define a multilingual. One should also consider

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for further investigations whether second-language learners should be considered separate from multilinguals, that is, people who are typically considered to have learned multiple languages relatively close together in time (if not simultaneously) and typically in the home setting (Dopke, 1997).

A previous study examining multiple-identity mindset and creative thinking found monoracials can take a similar mindset as multiracials (Gaither, Remedios, Sanchez, and Sommers 2015). Researchers found in this study that the flexibility linked to having multiple racial identities may be similar to having multiple social identities for monoracials, thereby boosting creativity in some domains (Gaither, Remedios, Sanchez, and Sommers 2015). One may extrapolate from that finding that in the case of this study, monolinguals may have the flexibility of those deemed multilingual in this study either due to other more flexible identities they themselves hold. Given that monolinguals in this category may have more knowledge of non-English languages than a group of monolinguals might outside of such an academic setting, it is possible this study's monolingual group have had enough exposure to foreign languages and their respective cultures that they are able to assume the more flexible view of social categories that has been associated primarily with multilinguals in the literature. The monolinguals in this study may have performed as well (and curiously, in the language domain) in forming truth-value judgments on social category statements simply because they are able to take the more malleable view of social categories one may initially assume is more expected in multilinguals. It is possible that monolinguals in this study held other multiple identities besides language status that enabled them to perform better on the truth-value essentialism tasks as compared to multilinguals.

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This experiment sought to expand upon previous studies examining essentialism and social categories, with a particular focus on how monolinguals versus multilinguals reason about social categories. This experiment failed to replicate the finding that participants are not as quick to make an accurate judgment about statements inconsistent with essentialist ideas. It is possible that multilinguals did not show less discord between learned knowledge and essentialist ideas as compared to monolinguals in this study because participants were not grouped into categories reflective of their true language proficiency. Further research using participants from the general population (as opposed to a university setting) may better capture true monolingual versus multilingual language proficiencies.

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Appendix A: Questionnaire to Gather More Information on Language Proficiency

Questionnaire:

1. What is the first language that you acquired? _____

2. Do you communicate in any additional languages? If yes, please specify the language(s) below:
 - a. Language #2: _____

 - b. Language #3: _____

 - c. Language #4: _____

3. What percentage of time do you communicate in these languages?
 - a. Language #1: _____

 - b. Language #2: _____

 - c. Language #3: _____

 - d. Language #4: _____

Please verify percentages add up to 100%

Language #2:

4. Where did you primarily learn your 2nd language (please circle)?

Home

School

Community

5. At what age did you first start **learning** your 2nd language? _____

6. Relative to a native speaker's performance, indicate your proficiency on a scale of 0-100:

Speaking



Understanding (comprehension)



Language #3:

7. Where did you primarily learn your 3rd language (please circle)?

Home

School

Community

8. At what age did you first start **learning** your 3rd language? _____

9. Relative to a native speaker's performance, indicate your proficiency on a scale of 0-100:

Speaking



Understanding (comprehension)



Language #4:

10. Where did you primarily learn your 4th language (please circle)?

Home

School

Community

11. At what age did you first start **learning** your 4th language? _____

12. Relative to a native speaker's performance, indicate your proficiency on a scale of 0-100:

Speaking



Understanding (comprehension)



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