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Listening Broadly: Comparing Cultural Differences in Holistic and Analytic Auditory Attention

Author
LeClair, Jessica

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Listening Broadly: Comparing Cultural Differences in Holistic and Analytic Auditory Attention

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by

Jessica Eva LeClair

Committee in charge:

Professor Heejung Kim, Chair

Professor Shelly Gable

Professor Kyle Ratner

Professor David Sherman

January 2018

The dissertation of Jessica Eva LeClair is approved.

Shelly Gable

Kyle Ratner

David Sherman

Heejung Kim, Committee Chair

August 2017

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VITA OF JESSICA EVA LECLAIR

August 2017

EDUCATION

University of California, Santa Barbara — Sept 2012 – present
Degree: Doctorate of Philosophy in Social Psychology
Area of Specialization: Cultural Psychology
Advisor: Heejung Kim
Expected graduate date: December 2017

Williams College — Sept 2006 – June 2010
Williamstown, Massachusetts
Degree: Bachelor of Arts in Biology (Honors) and Japanese
Academic Advisors: Joan Edwards, Kasumi Yamamoto

PROFESSIONAL EMPLOYMENT

Teaching Assistant — Fall 2012 – present
University of California, Santa Barbara

GRANTS AND AWARDS

UCSB Academia Senate Graduate Student Travel Grant	2016
National Science Foundation (NSF) East Asia & Pacific Summer Inst. (~$10K)	2015
UCSB Crossroads Grant Graduate Fellowship	2013
Japan-U.S. Educational Commission Fulbright Fellowship (~$40K)	2010 – 2011
Williams College Tompkins Travel Award	2009

PUBLICATIONS

LeClair, J., Sasaki, J., Ishii, K., Shinada, M., & Kim, H. (2016). Gene–Culture Interaction: Influence of Culture and Oxytocin Receptor (OXTR) Polymorphism on Loneliness. *Culture and Brain.*

Sasaki, J., LeClair, J., West, A., & Kim, H. (2016). The gene-culture interaction framework and implications for health. *Handbook of Cultural Neuroscience.*

Takasu, H., Ushio, M., LeClair, J., & Nakano, S. (2015). High contribution of Synechococcus to phytoplankton biomass in the aphotic hypolimnion in a deep freshwater lake (Lake Biwa, Japan). *Aquatic Microbial Ecology.*

LeClair, J., Janusonis, S., & Kim, H. S. (2014). Gene–culture interactions: a multi-gene approach. *Culture and Brain*, *2*(2), 122-140.

CONFERENCE PAPER PRESENTATION

LeClair, J., Pauketat, J., & Kim H. (2016) *Distinguishing Face and Honor Cultures: Role of Stability*. International Association for Cross-Cultural Psychology. Nagoya, Japan.

CONFERENCE POSTER PRESENTATIONS

LeClair, J., Pauketat, J., Kim, H., & Uchida, Y. (2015) *Characterizing cultural differences in responses to insults.* JSPS East Asia and Pacific Summer Institutes Program Orientation. Tokyo, Japan.

LeClair, J., & Pauketat, J. (2015) *Distinguishing face and honor cultures: responses to insults.* Cultural Preconference and SPSS Main Conference. Long Beach, CA.

LeClair, J., Cornick, J., Kim, H., & Ishii, K. (2014). *Cultural variation in auditory attention: Behavioral and physiological evidence.* SPSS Cultural Psychology Pre-conference. Austin, TX.

LeClair, J., Kim, H., & Ishii, K. (2013). *Cultural differences in auditory distraction.* SPSS Cultural Psychology Pre-conference. New Orleans, LA.

PROFESSIONAL SERVICE

Reviewer

SPSP GSC Outstanding Research Award 2013

University Committee Member

University of California Santa Barbara

Finance Committee Member, Beyond Academia Conference 2016 – 2017

Co-Founder, GoPSY Graduate Club, UCSB PBS Department 2015 – 2017

Chair of MiniConference Committee, UCSB PBS Department 2014 – 2015

ABSTRACT

Listening Broadly: Comparing Cultural Differences

in Holistic and Analytic Auditory Attention

by

Jessica Eva LeClair

Previous research has shown that across cultures, ways of thinking can influence perception and attention (Nisbett, Peng, Choi, & Norenzaya, 2001). In particular, Westerners tend to show a narrower, context-independent *analytic* processing style, while East Asians show a broader, context-dependent *holistic* style. Existing work on attention has utilized a variety of visual stimuli; however, domain general effects have not been tested. The present research focused on a new domain – namely listening – to provide compelling evidence for the deep-reaching influence of cultural thought patterns on attention. I designed a novel listening method, which required participants to either focus their attention on one of two voices, or divide their attention across two voices. We expected that the performance of analytically perceiving European Americans would be harmed by the additional challenge of listening to a second simultaneous talker, but that holistically perceiving East Asian Americans would be less harmed.

Further, we sought to examine how the speaker's rank, in other words the speaker's relative status in the social hierarchy, might further alter cultural patterns of basic attention.

Human communities differ not only in their social orientation but in other dimensions as well, including emphasis placed on positions held in the social hierarchy. I employed a rank manipulation, altering the speaker's status as either a fellow student or professor, to explore how cultural differences in accepting differences in social status and power would further moderate attention. Study 1 demonstrated that while grouping based on self-identified ethnicity did not predict patterns of attention, using the individual difference measure assessing analytic-holistic tendencies did predict the expected attention patterns. In Study 2, I show that the rank of the speaker affected accuracy differently across cultural groups. The work provides tentative support for the depth that culture can penetrate the mind, altering even seemingly basic processes like attention.

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Sensory perception is a cultural as well as a physical act. (Classen, 1997)

Even as you are reading this sentence, countless sources of sensory information are vying for your attention – the pressure of the chair against your back, the soft warmth of your shirt, the quiet murmuring of a conversation outside your door – to suggest a few. However, the capacity of human sensory processing is not limitless. At any moment, there are more competing sources of information from our environment than our brains can process. The human brain manages this flood of sensations by focusing on specific elements in the environment. As a result, attention acts like a filter to center focus, while simultaneously ignoring irrelevant and competing information. Devoting limited attentional resources to important information can alter our perception of the world. Irrelevant information might be forgotten or not even perceived at all.

The filter of attention is always present; however how attention is allocated may not be universal and thus may lead to meaningful differences in how people perceive their world. A growing body of research on culture and cognition has emerged showing remarkable variation in how people think about and attend to the world (e.g., Fiske, Kitayama, Markus, & Nisbett, 1998; Masuda & Nisbett, 2001; Nisbett & Masuda, 2003; Nisbett, Peng, Choi, & Norzenzayan, 2001). The suggestion that the broader cultural context can moderate a seemingly fundamental component of mental processes, like attention, provides compelling evidence for the depth that culture can penetrate the mind. Motivated by perspectives from social and cultural psychology, my research aims to provide an examination on how even a seemingly basic process like attention can be shaped by input from the sociocultural context.

To investigate cultural variation in perception, researchers have utilized a wide variety of stimuli from abstract shapes to complex moving scenes; however, existing evidence comes solely from the visual domain. Theoretically, researchers argue that observed group differences in perception are due to top-down influences, whereby cultural upbringing shapes thought processes (Nisbett et al., 2001). Ultimately, these chronically enforced cultural ways of thinking alter how individuals process the same stimuli. A critical test of the theorized influence from culture via thought to perception would be to investigate domain general results. Therefore, a key goal of this research is to examine cultural differences in a previously untested sensory domain – specifically audition – to provide compelling evidence for the deep reaching influence of culture on the mind.

Culture and Cognition

Research on cultural differences in attention built on work showing remarkable cultural variation in how people think about the world. Across societies, cultural psychologists have documented variation in cognition with some cultures exhibiting a more holistic cognitive style and others a more analytic style (Fiske et al., 1998; Nisbett, 2003; Masuda & Nisbett, 2001; Nisbett et al., 2001). Broadly defined, a holistic cognitive style emphasizes a broad attention to context and relationships. In contrast, an analytic cognitive style focuses on individual parts independent of the context in which they are embedded. Westerners tend to think analytically and East Asians tend to think holistically. These cognitive styles manifest in categorization, attribution, and reasoning (Chiu, 1972; Nisbett & Masuda, 2003; Nisbett & Miyamoto, 2005; Norenzayan, Smith, Kim, Nisbett, 2002; Varnum, Grossmann, Kitayama, & Nisbett, 2010). Analytically thinking Westerners tend to rely on rule-based categorization, dispositional attributions, and logical reasoning. In contrast, East Asian holistic thinkers show similarity based categorization, a tendency to make situational attributions, and a greater reliance on dialectical reasoning.

Empirical evidence for cultural tendencies towards holistic versus analytic cognitive styles has been shown in a variety of domains. For example, East Asians are less likely to commit the fundamental attribution error. The fundamental attribution error describes the biased tendency to rely on dispositional over situational attributions (Jones & Harris, 1967). Instead, holistically thinking East Asians are more likely to rely on contextual factors to explain behaviors (Miller, 1984). Children and adults from India and America were asked to explain two scenarios, one in which a person did something helpful and one where a person did something deviant. Young eight-year-old children across both cultures relied equally on dispositional and situational attributions. However, the older Americans became the more likely they were to rely on dispositional attributions. In contrast, as Indians became older, the pattern reversed with older Indians making significantly more situational attributions than dispositional attributions. Another study compared attributions for extreme behavior, namely mass murder (Morris & Peng, 1994). When asked to explain why a graduate student killed his former supervisor and staff, Chinese participants were more likely to refer to situational factors (e.g., "had a rivalry with a slain student"), while Americans were more likely to cite dispositional factors (e.g., "having a 'very bad temper' ").

Cultural psychologists have argued that differences in social orientation explain the observed differences in cognitive style (Nisbett & Masuda, 2003; Nisbett & Miyamoto, 2005; Varnum et al., 2010). Certain cultures, especially in North America and Western Europe, promote an *independent* social orientation valuing freedom, autonomy, and self-expression. Individuals are not constrained by fixed social roles and networks, thus focus can be directed to understanding the individual properties of discrete objects and agents separate from contextual factors. Other cultures, for example East Asian countries like Japan and Korea, promote an *interdependent* social orientation, emphasizing connectedness, social relationships, and harmony. Individuals exist within complex, interconnected social networks with prescribed responsibilities and hierarchical relationships. In such a society, understanding the social context is critical for smooth social functioning. Thus, focus is directed away from the self to the context. These chronically enforced ways of thinking about and perceiving the social world ultimately generalize to the physical environment (Nisbett et al., 2001). This process is promoted through socialization, for example parents guiding their child's attention in accordance with their own culturally enforced pattern of attention (e.g., Fernald & Morikawa, 1993).

The link between social orientation and cognitive style is supported by evidence comparing groups, differing in independence and interdependence. When comparing within European cultural tradition, researchers found that more interdependent Russians exhibited more holistic tendencies in categorization, attribution, attention, and reasoning, compared to Americans (Grossmann, 2009). Similar findings were reported in work comparing Americans to Croats, another interdependent European culture (Varnum, Grossmann, Katunar, Nisbett, & Kitayama, 2008). Even within Europe, more independent Germans exhibited more analytic patterns of attention compared to Russians (Medzheritskaya, 2008). Within nations, research comparing groups that differ in their primary economic activity has found that individuals from more interdependent communities (e.g., farming and cooperative fishing areas) exhibit more holistic tendencies, compared to individuals living and working in more independent communities (e.g., herding areas) (Uskul, Kitayama, & Nisbett, 2008).

Culture and Visual Attention

Extending research on cultural variation in cognitive styles, culture also appears to influence how people perceive and attend to the world around them. Westerners show object-focused visual processing, attending to focal objects, while East Asians exhibit context-based processing, attending to the broader context within which the object is embedded. In line with these predictions, earlier cross-cultural research found that when explaining classic Rorschach inkblots, Americans were more likely to focus on a small part of the inkblot, while Chinese tended to respond by utilizing the entire card (Abel & Hsu, 1949). More recent studies have implicated cultural differences in attention to what is perceived and remembered about complex visual scenes (Masuda & Nisbett, 2001; Masuda & Nisbett, 2006). In a study comparing responses from Japanese and American students, participants were shown animated scenes of fish swimming underwater in a stream (Masuda & Nisbett, 2001). When describing the video, Americans were more likely to start by mentioning salient focal objects (e.g., fish), while Japanese were more likely to begin their descriptions by referencing background elements and the relationships between objects and their background (e.g., the fish was swimming in front of the seaweed). Further, in a subsequent object recognition task, participants were shown either previously seen fish or novel fish, presented in their original setting or with a novel background. Japanese were more accurate at recognizing objects presented on their original background, suggesting that they had “bound” the object to its context (Chalfonte & Johnson, 1996). The change in background did not affect performance by American participants.

Cultural variation in attention also manifests in the ability to detect different types of visual changes. For example, in a study involving a variant of the change blindness paradigm

(Simons, 2000; Simons & Levin, 1998), participants were asked to detect small changes in a visual scene (Masuda & Nisbett, 2006). Participants were shown images with changes either to focal objects (e.g., the color of a plane) or to the contextual field (e.g., the position of a plane relative to the control tower). Japanese participants were more likely to identify changes to the background and to the relationship between objects, while American participants were more likely to detect changes to focal objects. Similar patterns have been shown with another version of the visual change detection paradigm with Americans quicker to detect color changes in the center of the screen compared to East Asians, who showed better performance when the visual field was expanded to cover a wider area (Boduroglu, Shah, & Nisbett, 2009).

Although cognition and attention styles are theorized to have social origins, cultural differences in attention appear even in the processing of highly abstract stimuli (Ji, Peng, & Nisbett, 2000; Kitayama, Duffy, Kawamura, & Larsen, 2003). For example, cultural variation in focusing on objects versus context predicts performance on visual tasks related to field dependence (Ji et al., 2000). Field dependence is assessed with the rod and frame task, which involves judging the verticality of a central rod independent of the position of the surrounding wooden frame. Compared to Westerners, the judgments of East Asians indicated greater influence from the position of the surrounding frame, suggesting that East Asian participants had more difficulty separating the rod from the frame. However, depending on the structure of the task, the context-focused processing of East Asians can aid accurate performance. In a study utilizing a novel line-frame task (Kitayama et al., 2003), participants were shown a line presented within a surrounding square frame, and then were shown an empty square frame of a different size. Participants either had to draw a line in the square, which was the same length relative to the frame as the previous line, or which was the same absolute length as the previous line. East Asians were better in making contextually-based relative judgments, while Westerners performed better in the absolute task. These attentional styles, arising from culture, have their own strengths and weaknesses depending on the task and type of stimuli being processed.

Auditory System

Building upon the existing research showing how cultural background can shape how we attend to and perceive the visual world, I will examine cultural differences in auditory attention. Both seeing and hearing, as ways that humans interact with the world, may potentially be influenced by sociocultural ideas and practices that tend to promote different ways of thinking about the world. Theoretical reasoning points to attention, as the underlying link between the various sensory systems. Within the brain, although visual and auditory systems operate somewhat independently, a growing body of evidence suggests that multisensory convergence is considerably more widespread than originally thought (Bizley & King, 2012). Researchers have even argued for including primary cortical areas in the network of multisensory regions (Ghazanfar & Schoreder, 2006). In both visual and auditory attention tasks, overlapping regions of the brain were activated, including the left mid-lateral prefrontal cortex and the inferior parietal cortex (Salo, Rinne, Salonen, & Alho, 2013), areas of the brain implicated in attention (Corbetta, Miezen, Shulman, & Petersen, 1993; Giesbrecht, Woldorff, Song, & Mangun, 2003; Posner & Peterson, 1990; Yantis, Schwarzbach, Serences, Carlson, Steinmetz, Pekar, & Courtney, 2002). The neuroanatomical evidence suggests that the auditory and visual system are connected through attention. Thus, cultural goals that direct attention allocation either narrowly or broadly should operate within both the auditory and visual systems. Therefore, I suggest that when attending to auditory information, East Asians will exhibit a broader more holistic pattern of attention and Westerners will exhibit a narrower more analytic pattern, as has been previously demonstrated with visual attention tasks.

Compared to the dominant visual system, the auditory system may appear to be a less consequential system to study. A mere 3% of neurons in the brain is devoted to hearing (Grady, 1993). In comparison, an estimated 50% of the human brain is involved in some way with processing visual information (Sereno et al., 1995). In addition to brain regions devoted to processing, hearing lags behind vision by other measures as well. In a memory task, participants were worse at remembering sounds they heard, compared to objects they saw, at later time points ranging from 30 seconds to a week (Bigelow & Poremba, 2014). Auditory memory lagged behind even tactile memory, in conditions where participants were asked to remember objects they touched. From an everyday experiential perspective, vision is clearly valued over hearing. When asked whether they would rather lose their sense of sight or their sense of hearing, the vast majority of participants chose deafness (77%) over blindness (16%) (Kim, Goldman, & Biederman, 2008).

From the perspective of attention, the auditory system is relatively less controllable with broader sensing capacities, and thus presents a rigorous domain in which to study cultural influences on attention. Hearing operates in all directions, compared to the directional nature of sight controlled by eye movements. Further, humans can even hear "through" objects, since sound waves pass through solid objects unlike light waves. Hearing is highly sensitive. The visual system reaches its maximum discriminatory limit at around 25 events per second, explaining why the industry standard frame rate of 25 frames per second fools the human eye into perceiving continuous movement. However, hair cells can lock on to vibrations up to 5,000 times per second, meaning that humans can hear changes in auditory events that occur at 200 times per second (Horowitz, 2012). And perhaps most obviously, humans can close their eyes but our ears are always open to listen and take in auditory information. The auditory system is even active during sleep retaining the ability to discriminate between sounds (Davis, Davis, Loomis, Harvey, & Hobart, 1939; William, Zung, & Wilson, 1961). The auditory system is continuously flooded with information from all sides and at long distances, and thus the filter of attention becomes critical to selecting and managing incoming information. The relatively less controllable nature of the auditory system makes it a key comparison with the visual system. Our study attempts to test whether culture can penetrate a system that is less controllable, challenging the idea that processes within such systems may be universal and fixed beyond the influence of environment.

Cultural influences begin early through listening, since our sense of hearing begins developing earlier and fully matures before vision. At birth, hearing functions at the same level as adult hearing (Sininger, 1999). In comparison, both acuity and color perception are impaired in infant vision compared to adults (Atkinson, 2002). The sense of hearing develops first and starts functioning around 18-20 gestational weeks (Pujol & Uziel, 1986). Sounds from the environment can be heard inside the womb, especially the mother's own voice, which shows only limited attenuation after traveling through amniotic fluid (Benzaquen, Gagnon, Hunse, & Foreman, 1990; Querleu, Renard, Versyp, Paris-Delrue, & Crepin, 1988).

The effects of early exposure to environmental sounds are evident at birth. Newborn infants enter the world with knowledge of speech and other sounds. Infants prefer their own mother's voice compared to the voice of a stranger (DeCasper & Fifer, 1980). The visual equivalent – preferring their mother's face compared to a stranger's voice – does not develop for another three months (Burnham, 1993). This finding is no surprise given that visual information cannot reach the fetus in the womb as auditory information can. The early development of hearing suggests the startlingly idea that even at birth children have already been exposed to and possibly influenced by the sounds of the particular cultural environment in which their mother lives.

Early active listening by human fetuses has consequences for the sounds that infants later produce themselves in line with their cultural environment. For example, in the first day of their lives, French infants cry in a different way than German babies (Mampe, Friederici, Christophe, & Wermke, 2009). Babies tended to produce cries that matched the intonation pattern of their mothers' native language. French babies produced cries with a rising melody, while German babies produced cries with a falling melody. The effects of early exposure to sounds and spoken language persist until later language development. Pre-language infants adopted to Dutch families from Korean biological parents showed more fluent production of Korean sounds later, compared to Dutch born infants, despite never having learned Korean (Choi, Cutler, & Broersma, 2017). Babies can begin to acquire cultural knowledge before birth through exposure to environmental sounds, and further that exposure can alter the sounds that babies and growing children produce later. This demonstrates the mutual influence between culture and listening, and points to the pathways through which culture could influence perception.

Cultural Influences on Auditory Perception

The sounds of our environment, like the visual landscape of our environment, occur within a cultural context and further are produced by individuals within that context. In this way, culture can provide two types of influence on the auditory system. First, culture may exert bottom-up influence through exposure to culturally variant soundscapes. In addition, culture may exert top-down influences through cultural upbringing affecting thinking, which in turns alters perception (Nisbett & Masuda, 2003; Wong, Chan, & Margulis, 2012).

Sounds across cultures. First, exposure to culturally variant stimuli in our auditory environment (or "soundscape") could influence the auditory system through bottom-up influences. This pattern has been found using visual landscapes across cultures (Miyamoto, Nisbett, & Masuda, 2006). Equivalent landscapes in Japanese environments were found to be more complex, compared to North American landscapes. And further, exposure to these different landscapes created differences in holistic versus analytic tendencies. Similarly, exposure to different sounds across cultures could condition how we respond to those sounds and to others that we encounter. Perhaps the most obvious example of culturally variant sounds is language. Arriving to an airport and hearing the public announcements in a new language provides an immediate and inescapable cue that we have crossed a cultural boundary. Spoken language represents only one type of environmental sound, which may differ across cultures. The field of soundscape ecology provides a conceptual framework to understanding the full collection of sounds emanating from a landscape. The framework identifies three sources of environmental sounds – sounds created by organisms (or *biophony*), nonbiological ambient sounds (or *geophony*), and sounds created by humans (or *anthrophony*) (Pijanowski, Villanueva-Rivera, Dumyahn, Farina, Krause, Napoletano, Gage, & Pieretti, 2011). The source and composition of each of these three types of sounds could presumably vary across cultures. For example, morning birdcalls (*biophony*) can signal one's location in a particular region of the world. Or consider that a tropical location would offer a distinct set of environmental sounds (*geophony*) – the crash of ocean waves and the rustling of palm fronds – compared to an icy northern landscape.

Patterns of cultural variation in sounds created by humans (*anthropony*) may be evident when examining how people in different culture produce cultural products (e.g., Morling & Lamoureaux, 2008). A cultural product is a tangible, public representation of culture. Within the visual domain, these products include pictures and visual displays, for example magazine advertisements (Kim & Markus, 1999), conference posters (Wang, Masuda, Ito, & Rashid, 2012), and church websites (Sasaki & Kim, 2011). Sounds created in an environment are similarly tangible, in that sounds can be experienced through the senses, and thus arguably can be conceived as cultural products. Research on visual cultural products suggests that East Asians produce denser and more complicated visual displays compared to North Americans (Wang, Masuda, Ito, & Rashid, 2012). East Asians as more holistic thinkers are presumed to be accustomed to taking in more peripheral information, giving an advantage in integrating across such dense and detailed displays. In contrast, North Americans, as more analytic thinkers, would not emphasize detailed information, instead favoring simple designs. Similarly, sound environments in Asian versus Western contexts may be noisier with more multilayered sounds.

Thought across cultures. In addition to bottom-up effects through cultural exposure, researchers have proposed that culture can also exert top-down influences on perception through cultural upbringing. Researchers argue that cultural values, practices, and meaning conveyed through socialization can shape ways of thinking, which in turn influence ways of perceiving (Nisbett & Masuda, 2003; Wong, Chan, & Margulis, 2012). This can lead to consistent differences in perception across cultures. In other words, what I am seeing and hearing may not be what you are seeing and hearing. The subjectivity of perception suggested by cultural psychologists is consistent with earlier work within the "New Look" paradigm. Researchers showed that for poorer children, coins were perceived as larger than cardboard discs, compared to more affluent children, presumably due to the value and positive affect assigned to coins by the poorer children (Bruner & Goodman, 1947). Similar to visual objects, environmental sounds can also be meaningful events, and thus the meaning assigned to sounds could influence subjective perception (Dubois, 2000). As a simple example – consider that the music that your friend chooses to buy might sound like "noise" to you. Indeed, objective measures of sound (like volume) appear to be poor predictors of subjective experience. For example, when asked to rate sounds along the emotional dimensions of vibrancy and calmness, ratings varied widely although the sounds did not differ in DbA level (a measure of the relative loudness of sounds in air as perceived by the human ear). In another study, feelings of irritation caused by traffic sounds were predicted by whether participants held negative attitudes towards reckless driving (Hiramatsu & Minoura, 2000). The meaning assigned to a sound can contribute to the subjective experience of the sound. In the context of culture, that evaluation is highly cultural, since it relies on meaning and values, which can vary across cultural contexts.

Existing work provides evidence for the ways that auditory perception can vary across cultures. One study examined the impact of metaphors on pitch perception (Shayan et al., 2011). Metaphors can reflect thinking processes and thus can serve to reflect different cultural information (Su, 2002). In English, "high" and "low" are used to describe tones, while Dutch use "thick" and "thin." Dutch and American participants were asked to judge the pitch of tones, which were simultaneously presented with lines that differed in their height (matching the American metaphor of high/low pitches) or in their width (matching the Dutch metaphor of thin/thick pitches). When the height of the line did not match the pitch, Americans were less accurate, but their performance was not harmed by the presentation of thick or thin lines. The results were opposite for the Dutch, suggesting that how participants abstractly conceived pitches, represented in cultural metaphors, affected their tone judgments. Another study examined how cultural variation in self-concept affects sound perception (Cao & Gross, 2015). Sensory attenuation is presumed to be a universal phenomenon, in which self-generated sounds are perceived as less intense than other-generated sounds. This pattern held for British, who have an independent self-concept, which emphasizes the distinctiveness of the self from others. However, sensory attenuation was not found in interdependent Chinese, who hold a self-concept that emphasizes the overlap between the self and others, especially for close others.

Both top-down and bottom-up processes jointly contribute to Asians having a broader and more context-based attention style, while influencing Westerners to develop a narrower and more context-independent attention style. Auditory stimuli are heard within the context of a particular culture, and in turn, cultural upbringing and practices can shape how those stimuli are perceived. This cycle of interaction between the mind and cultural world illustrates the cultural psychology framework of mutual constitution (e.g., Fiske, Kitayama, Markus, & Nisbett, 1998). The human mind is both a product, as well as a producer of culture. The present research will not attempt to separate these joint influences. Instead, it will on the observable outcome of these pressures namely broader attention in Asians and more focused attention in Westerners within the domain of listening.

Overview of Present Research

Existing research on cultural variation in perception has overlooked different sensory domains, focusing on visual processing. Just as visual attention occurs within the cultural context, I suggest that auditory attention also functions within the larger situational and cultural context. The present research aims to examine how culture affects attention, by combining research on culture and perception with methodology from auditory listening studies. I hypothesized that East Asians and European Americans would show similar culturally specific patterns of attention with auditory stimuli, as has been previously demonstrated with visual stimuli. Specifically, I hypothesized that East Asians would have a harder time ignoring background sounds but would be relatively better at directing their attention to the whole field across multiple stimuli. In contrast, I predicted that European Americans would be better at ignoring background sounds and directing their attention to distinctive focal sounds, and would have more difficulty when asked to broaden their focus across multiple competing and difficult to distinguish streams of information. A second aim of the research was to investigate how certain social factors related to culture might further moderate these culturally specific patterns of attention.

In Study 1, I administered a social listening task designed to assess the ability to focus attention on a focal voice versus divide attention across multiple voices. Participants heard two voices, and were instructed to listen to one voice or both, and then respond by clicking on the screen matching the spoken message they just heard. Consistent with a theorized tendency towards holistic processing, I predicted that East Asians would have a harder time ignoring an irrelevant stream of information, but would be relatively better at dividing their attention across multiple streams of information, compared to European Americans. Both groups were expected to show reduced performance when dividing their attention, although the reduction was expected to be larger for European Americans relative to East Asian Americans. Going beyond group-level cultural comparison, I also included the Locus of Attention subscale of the Analism-Holism scale (Choi, Koo, & Choi, 2007), assessing holistic reasoning as an individual difference measure to predict task performance. Next in Study 2, I sought to replicate Study 1 while adding an additional factor. By providing information about the different voices that participants heard, I sought to change the meaning and relative importance of the voices to examine how additional social factors might alter cultural patterns of attention.

Study 1

Study 1 served as our initial investigation into whether the cultural background of participants predicted the ability to ignore versus attend to contextual information. The study assessed differences in narrow versus broad processing of auditory information using a social listening task. I used an adaptation of the Coordinate Response Measure task (CRM; Bolia et al., 2000; Brungart, 2001), which is designed to measure auditory selective attention. In the task, participants heard spoken messages, which included a specific color and number, and then respond by clicking on the appropriately colored and numbered button presented on the screen. In single voice trials, participants heard a single voice, in two voice trials participants heard two voices simultaneously and were directed to respond to either one or both voices. In all trials, I measured accuracy and speed of response.

In two voice trials, participants heard two simultaneous recordings and were instructed to pay attention to one target voice (*focal only task*) or to both voices (*focal + background task*). These tasks are conceptually based on the visual attention framed-line test

(FLT; Kitayama et al., 2003), which assesses the ability to incorporate contextual information (relative task) and the ability to ignore contextual information (absolute task). In the FLT, participants are shown a frame with a line inside and in a separate frame, either asked to reproduce a line of the same proportional length (relative task) or the same exact length (absolute task). East Asians performed better on the relative task, which requires incorporating contextual information, while European Americans performed better on the absolute task, which requires greater ability to ignore additional information.

Based on previous research on the limited capacity of attention (e.g., Broadbent, 1958) and the difficulty of separating simultaneous audio streams (Bregman, 1990), I predicted that European Americans and Asian Americans would show reduced accuracy in the double voice trials, compared to the single voice trials. Our key hypothesis was about the differential performance of European Americans and Asian Americans in the focal + background task, which requires dividing attention, versus the focal only task, which requires focusing attention and ignoring competing information. Overall, I expected that regardless of culture, the focal + background task, which requires dividing attention between two simultaneous streams of auditory information, would be more difficult than the focal only task. However, given past research demonstrating that European Americans are better at ignoring context while Asian Americans are better at incorporating context in a visual task (Kitayama et al., 2003), I predicted similar patterns with auditory attention in the social listening task. Specifically, I predicted that the reduction in performance between the focal + background and focal only task would be smaller for East Asians Americans. In other words, compared to European Americans, East Asians Americans would be relatively less harmed by the additional challenge of having to listen and respond to not just one, but two speakers.

As further evidence of their relatively greater advantage at dividing attention, I predicted that East Asian Americans would be more accurate at responding to the background voice in the focal + background task, compared to European American participants.

Method

Design and Participants

This study had a 3 (task: single, focal only, focal + background; within-subject) x 2 (participant culture: European American and East Asian American; between-subjects) design. The full sample had 202 University of California, Santa Barbara undergraduate participants (73% female, M_{age} = 18.9, SD = 1.30), including 75 East Asian Americans (67% female, M_{age} = 18.9, SD = 1.32) and 82 European Americans (74% female, M_{age} = 18.8, SD = 1.27). East Asian Americans (i.e., those who identified themselves as from South Korea, Japan, and China) and European American participants were recruited based on their self-categorized ethnicity in pre-screening question. Among the East Asian Americans students, there were 41 Chinese, 10 Korean, 6 Taiwanese, and 1 Japanese. In addition, there were 2 participants of mixed race (including Japanese/Chinese and Chinese/Cambodian). Further, there were 11 unspecified students (e.g., "Asian"). Among the unspecified students, 10 reported being born in China and 1 reported being born in Korea. On the basis of self-reported birthplace, the unspecified students were also included in our sample of East Asian Americans. In addition, there were 44 Asian American not East Asian countries (78% female, M_{age} = 19.1, SD = 1.31). Participants classified as non-East-Asian Asian Americans included students from Vietnam (13), the Philippines (15), India (11), Indonesia (1), Pakistan (1), and of mixed Vietnamese/Chinese background (3). Among the East Asian Americans, 37 were born outside the U.S., while 38 were born in the U.S. Among the non-East Asian Americans, 17 were born outside the U.S., while 29 were born in the US. Among the European American students, the majority were born in the U.S. (77 students) with only 5 students born outside the U.S. (specifically: Bulgaria, Canada, Denmark, and England). I selected for participants, who indicated in the pre-screening questionnaire that they had not been previously diagnosed with any hearing impairments. Participants were recruited through the Psychological and Brain Sciences Department participant pool (paid and credit). For their participation, participants received course credit (.5 credits) or monetary compensation ($5).

Materials & Procedure

Social auditory task. Upon arriving to the lab, participants were told that they would complete a simple cognitive listening task and answer a few basic survey questions. Participants were seated in front of a computer and asked to wear a pair of headphones. Any further instructions were presented on the computer screen.

First, participants were asked to complete the social auditory task, in which they listened to and responded to spoken messages. The listening task was adapted from the Coordinate Response Measure (CRM) task, developed at the United States Air Force Research Laboratory (Bolia et al., 2000; Bungart, 2001a). The task is designed to assess informational masking in auditory selective attention. Informational masking describes the reduced detection of sounds embedded in the context of other similar sounds (Watson et al., 1976; Pollack, 1975). Sentences in the CRM task are in the form of “Ready *call sign*, go to *color number* now.” Within the set, there are 8 *call signs* (e.g., “baron,” “Charlie,” “tiger”); 4 *colors* (red, blue, green, and white); and 8 *numbers* (1, 2, 3, 4, 5, 6, 7, 8), yielding 256 phrase combinations, which are spoken by 8 talkers (4 male and 4 female). Across talkers, the phrases were standardized for volume and length. In a basic trial, participants hear a recorded phrase and respond by clicking on the appropriately colored and numbered button shown on the screen. For example, a participant might hear "*Ready tiger, go to red four now!*" The correct response would be to click on the red button marked with the number "4."

In the present research, the call sign "Charlie" was used as a cue to mark the focal voice that participants were asked to direct their attention to. For trials in which participants heard a single voice, I randomly selected any messages in which the speaker said "Charlie" followed by any color or number. For trials in which participants heard two voices simultaneously (focal task and focal + background task), two audio files were paired, selecting for one message where the speaker said "Charlie" followed by any color or number and a second audio file where the speaker said any other call sign, any other color, and any other number. The second speaker was randomly chosen from the remaining speakers. The stimuli were prepared such that the paired files had a mix of gender pairings, including same gender pairings (male-male and female-female), as well as mismatched gender pairings (male-female). For male-female pairings, the assignment of the male or female speaker to the focal voice was counterbalanced. (For details on files pairings, see Appendix I.) After hearing the spoken message, participants responded by clicking on the correct response button. On the screen were displayed 32 response buttons, arranged in different color matrices and showing 8 buttons numbered 1 through 8. I recorded button clicks, as well as reaction time in milliseconds.

Since the task as assumed to be unfamiliar to most (if not all) participants, participants first completed 15 single voice trials, in which they heard a single message and were asked to respond by clicking the corresponding button. Following the simple single voice trials, participants completed two double voice versions of the task, which were designed to evaluate the ability to ignore contextual information. In both tasks, participants heard two voices speaking simultaneously. The focal voice always started with “Ready Charlie…” In the focal only task, participants were instructed to listen and respond only to the voice saying “Ready Charlie...” In the focal + background task, participants were instructed to pay attention to both voices and that they would be asked first about the focal voice saying “Charlie” and then asked about the second background voice. Participants heard two blocks each of the focal task and the focal + background task with order counterbalanced. Each task had 2 blocks with 15 trials each (total of 60 trials across both tasks). (See Figure 1.)

To calculate accuracy, participants were given a score from 0 – 2 for each trial. A score of 0 indicated that the participant selected both the incorrect color and the incorrect number. A score of 1 indicated that the participant selected either the correct color or the correct number (e.g., if the focal message was “Ready Charlie, go to blue 2,” then the participant could select either a blue button of any number, or a 2 button of any color). A score of 2 indicated that the participant selected both the correct color and the correct number. For each task – single, focal only, and focal + background, I averaged accuracy scores across the trials and across the blocks to yield a single accuracy score for each task condition.

Questionnaires. After completing the auditory task, participants answered the following series of measures on a computer: the Analysis-Holism Scale, AHS (Choi, Koo, & Choi, 2007). The AHS includes 24 items designed to assess the extent to which individuals show analytic versus holistic thinking tendencies. I focused on the Locus of Attention subscale, which consists of 6 items, rated on a 1 (strongly disagree) to 7 (strongly agree)

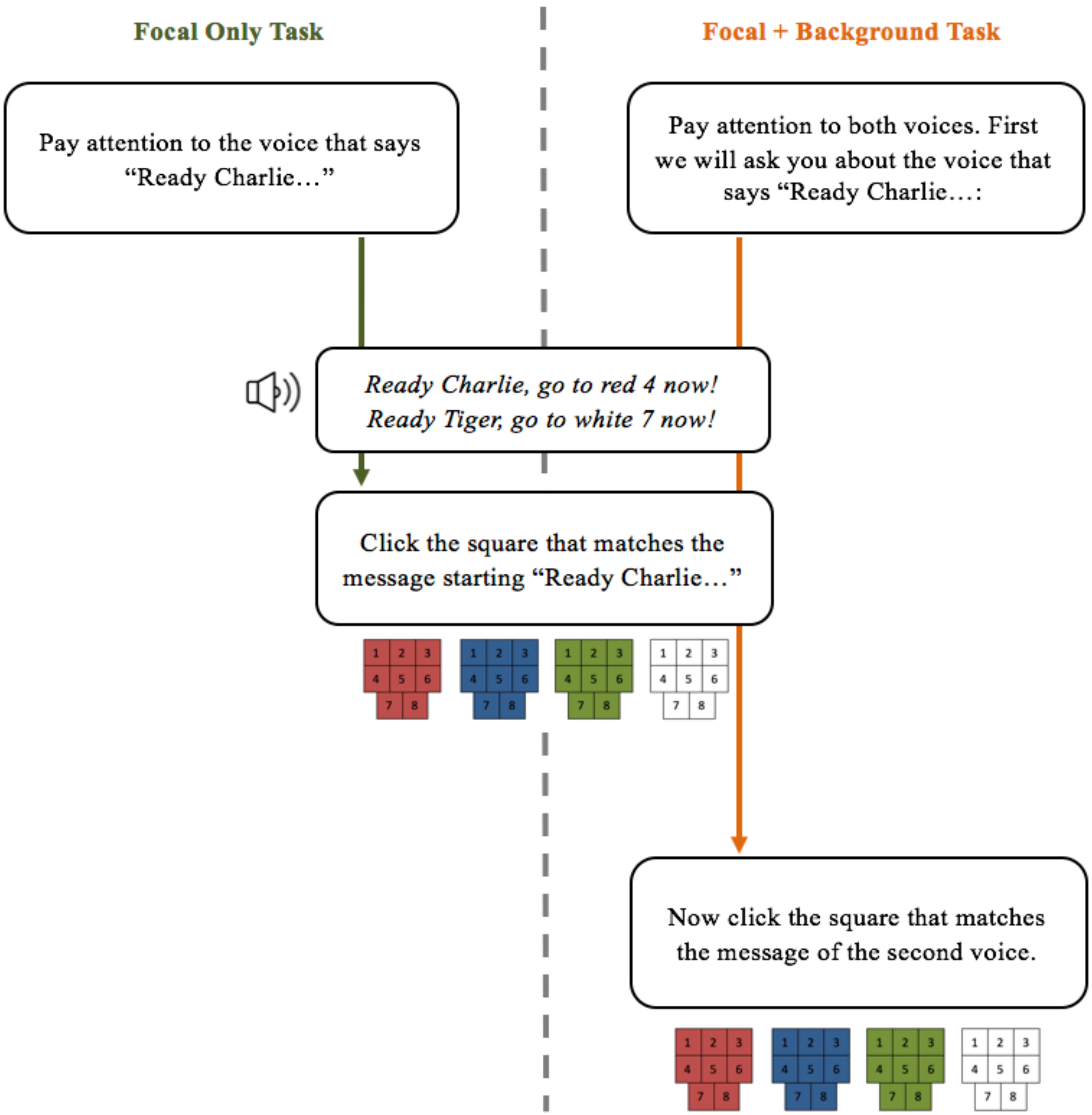

Figure 1. Visual explanation of *focal only* and *focal + background* tasks, adapted from Coordinate Response Task (CRM, Bolia et al., 2000; Bungart, 2000a).

scale (α = .630). Example items include, "*The whole, rather than its parts, should be considered in order to understand a phenomenon*" and "*It is more important to pay attention to the whole rather than its parts.*" Demographic questions included age, sex, place of birth, and language spoken at home. Participants answered two questions about their English comprehension and fluency (see Appendix II), which were averaged to create a single composite of English ability ($r = .842$, $p < .001$). At the end, participants were debriefed.

Results

First, to examine the cultural differences in the ability to selectively focus on the focal voice versus divide attention between the focal voice and background voice, I conducted a 3 (task: single, focal only, focal + background; within-subjects) x 2 (culture: East Asian American, European American; between-subjects) mixed model ANOVA on task accuracy score.[1] Given research and theory underscoring the cognitive and attention differences between East Asia and North American contexts, I focused on comparing between East Asian Americans and European Americans. As predicted, I found a significant main effect of task condition, $F(2, 154) = 720.4$, $p <.001$. Regardless of cultural background, all participants performed worse in the focal + background task ($M = 64.3\%$, $SD = 1.07$) compared to the focal only task ($M = 79.5\%$, $SD = 11.1$) with nearly perfect performance in the single voice trials ($M = 98.8\%$, $SD = 3.30$). As predicted the focal + background task, which required dividing attention between two speakers, was the most challenging for all participants. There

[1] No significant results were found, when using reaction time in milliseconds as the outcome variable. Due to programming constraints, the survey page refreshed between the audio file and the page showing the response matrix. All participants showed similar patterns of clicking on the appropriate button. Given the time lag, the reaction time measure proved to be a poor assessment of reaction to the audio file itself. Rather the reaction time measures more likely reflects the time it takes for participants to look at the screen and move the cursor to the response button.

was also a significant main effect of culture, $F(1, 154) = 7.728$, $p = .006$, such that East Asian Americans overall showed lower accuracy ($M = 77.0\%$, $SE = .700$) compared to European Americans ($M = 81.9\%$, $SE = .679$). The interaction between task and culture was also significant, $F(2, 154) = 3.574$, $p = .040$. Compared to European Americans, East Asians performed significantly worse in the focal only task ($p = .006$), while only marginally worse in the focal + background task ($p = .062$). There were no cultural differences in the single task ($p = .658$). (See Figure 2.)

Given the ceiling effects on performance with the single voice condition, I excluded the single voice condition and conducted a 2 (task: focal, focal + background; within-subjects) x 2 (culture: East Asian American, European American; between-subjects) mixed model ANOVA on task accuracy score. Again as predicted, there was a significant main effect of task, $F(1, 155) = 287.9$, $p < .001$, with all participants showing reduced accuracy in the focal + background task ($M = 64.4\%$, $SD = 10.8$) compared to the focal only task ($M = 79.6\%$, $SD = 10.8$). There was also a main effect of culture, $F(1, 155) = 7.493$, $p = .007$. East Asian Americans performed worse overall ($M = 69.9\%$, $SE = 1.05$) compared to European Americans ($M = 73.9\%$, $SE = 1.00$), regardless of the task.

The interaction between task and culture was not significant, $F(1, 155) = .695$, $p = .406$. Although the interaction was not significant, I conducted the planned pairwise comparisons as originally intended to examine the key hypothesis that East Asian American performance would be relatively less harmed by the task that required dividing attention rather than focusing attention. In other words, the key comparison of interest was focal voice accuracy in the focal only task versus focal voice accuracy in the focal + background task.

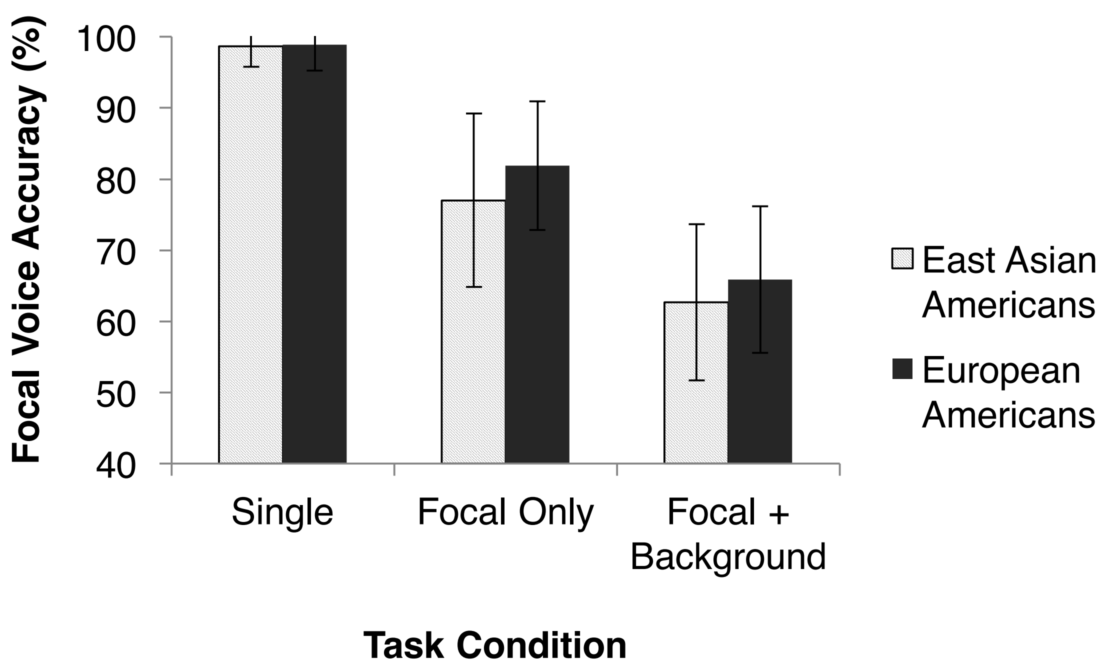

Figure 2. Interaction between culture and task condition on focal voice accuracy rate.

East Asian Americans (M = 77.2%, SD = 12.2) performed significantly worse in the focal only task, compared to European Americans (M = 81.9%, SD = 9.06) (p = .006). East Asian Americans (M = 62.7%, SD = 11.0) also had marginally decreased performance in the focal + background task, compared to European Americans (M = 65.9%, SD = 10.3), (p = .062). The reduction was smaller in terms of absolute value, although the difference was not statistically significant. The findings did not support the prediction that East Asian Americans would show a relatively smaller reduction in performance, when asked to divide their attention between two simultaneous auditory streams, compared to European Americans. Further, when examining background voice accuracy in the focal + background task, the pattern was contrary to predictions. When responding to the background voice, European Americans (M = 60.5%, SD = 11.9) actually performed better than East Asian Americans (M = 55.2%, SD = 11.8), $t(155) = 2.763$, p = .006.

Exploratory analyses accounting for fluency. The findings that East Asian Americans had lower accuracy overall, including for the background voice, could be attributed to language fluency effects. The task involved understanding spoken phrases in English, which may have advantaged native English speakers. Compared to European American participants, significantly fewer East Asian Americans reported being born in the United States, $\chi^2(1, N = 159) = 37.7$, $p < .001$, speaking English as their native language, $\chi^2(1, N = 155) = 50.2$, $p < .001$, and using at least some English at home (e.g., "English and Chinese"), $\chi^2(1, N = 156)$ 57.9, $p < .001$. Further, for East Asian Americans[2], English ability predicted greater focal voice accuracy in both the focal only task ($r(75) = .338$, $p = .003$) and in the focal + background task ($r(75) = .295$, $p = .010$). There was also a positive correlation between English ability and background voice accuracy ($r(75) = .360$, $p < .001$).

First, to explore the influence of English fluency on task performance, I re-analyzed the two primary ANOVA analyses limiting the East Asian American sample to the 38 individuals born in the United States. I conducted a 3 (task: single, focal only, focal + background; within-subjects) x 2 (culture: US-born East Asian American, European American; between-subjects) mixed model ANOVA on task accuracy score. I found a significant main effect of task condition, $F(2, 112) = 465.3$, $p <.001$. Regardless of cultural background, all participants performed worse in the focal + background task ($M = 65.5\%$, $SD = 9.94$) compared to the focal only task ($M = 81.8\%$, $SD = 9.18$) with nearly perfect performance in the single voice trials ($M = 98.8\%$, $SD = 3.47$). However, by selecting only U.S.-born East Asian Americans, I found no significant main effect of culture, $F(1, 113) = .070$, $p = .792$. The interaction between task and culture was not significant, $F(2, 112) = .449$,

[2] The majority of European American participants reported native-level English fluency and comprehension. There is insufficient variance to test the correlation with accuracy.

p = .639. Given the ceiling effects on performance with the single voice condition, I conducted a 2 (task: focal, focal + background; within-subjects) x 2 (culture: US-born East Asian American, European American; between-subjects) mixed model ANOVA on task accuracy score, again limiting the sample to U.S.-born East Asian Americans. There was a significant main effect of task, $F(1, 113) = 267.7$, $p < .001$. But there was no significant main effect of culture, $F(1, 112) = .091$, $p = .764$ or interactive effect of culture by task, $F(1, 113) = .724$, $p = .397$. Given that selecting only U.S.-born East Asian Americans eliminated the group differences with European Americans suggest that place of birth, possibly tied to language fluency accounts for the consistent cultural difference I found.

To address the alternative explanation that English fluency accounts for cultural differences in performance, I conducted a series of analyses examining another characteristic of the spoken messages – gender matching of the paired speakers. I focused on the matching (or mismatching) gender of the speakers to examine cultural differences in performance across varying degrees of difficulty. Intuitively, matched gender voices (i.e., male with male, or female with female) seemed more difficult to separate. Indeed, at mean level, the mismatched gender trials were easier for both East Asian Americans and European Americans, supporting my intuition. If East Asian Americans were performing worse particularly due to language difficulties, then I would expect the greatest cultural difference in performance on the most challenging task (i.e., the *focal + background task*) with the greatest difficulty (*i.e.*, the matched gender trials).

In the paired audio files used for the focal only task and focal + background task, there were a combination of female-female pairings (11 trials), male-male pairings (12 trials), and female-male pairings (37 trials). To control for baseline cultural differences in performance, performance in the focal task was used as a covariate in the following analyses. The first exploratory analysis examined accuracy for the focal voice from the focal + background task, using a 2 (gender matching: same versus mismatched; within subjects) x 2 (culture: East Asian American versus European American) mixed-model ANOVA controlling for focal voice accuracy in the focal only task. Compared to same gender pairings (East Asian Americans: *M* = 55.3%, *SD* = 8.92; European Americans: *M* = 56.3%, *SD* = 10.8), all participants had greater accuracy of response in the mismatched gender trials (East Asian Americans: *M* = 69.5%, *SD* = 16.1; European Americans: *M* = 75.5%, *SD* = 14.6), $F(1, 154) = 10.466$, $p = .001$. This result is not surprising, as the mismatching of speakers might have accentuated the difference between the speakers and made the messages easier to distinguish. There was no significant main effect of culture, $F(1, 154) = .809$, $p = .370$, and no interactive effect between gender matching and culture, $F(1, 154) = 1.141$, $p = .287$. (See Figure 3.)

The second exploratory analysis examined accuracy for the background voice in the focal + background task, using a 2 (gender matching: same versus mismatched; within subjects) x 2 (culture: East Asian American versus European American) mixed-model ANOVA controlling for focal voice accuracy in the focal only task.

Again, I found a main effect of gender matching condition, such that the mismatched gender condition was easier (East Asian Americans: *M* = 61.0%, *SD* = 16.6; European Americans: *M* = 69.5%, *SD* = 14.5) for both cultural groups, compared to the same gender condition (East Asian Americans: *M* = 49.5%, *SD* = 11.1; European Americans: *M* = 51.4%, *SD* = 12.6), $F(1, 154) = 4.892$, $p = .028$.

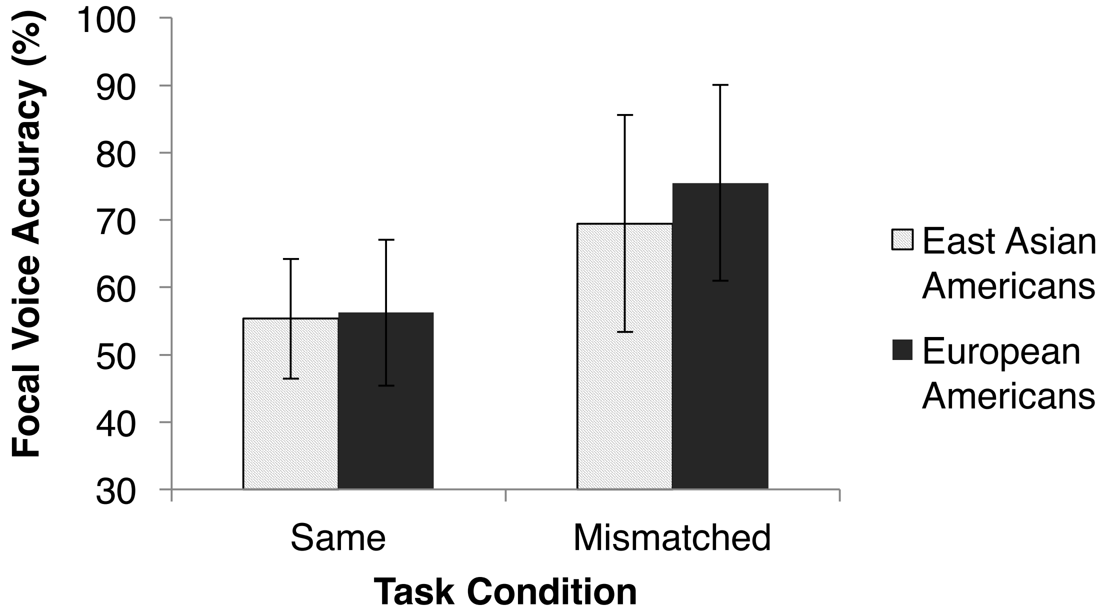

Figure 3. Interaction between gender of the paired speakers and culture on the accuracy rate of the focal voice in the focal + background task, controlling for focal voice accuracy in the focal only task.

There was a marginally significant main effect of culture, $F(1, 154) = 2.937$, $p = .089$, and a significant interaction between gender matching and culture, $F(1, 154) = 4.422$, $p = .037$, with both cultural groups performing equally well in the same gender condition ($p = .707$) but East Asian Americans performing worse in the mismatched gender condition compared to European Americans ($p = .019$). (See Figure 4.)

The secondary exploratory analysis provides tentative support that our pattern of findings is not purely due to differences between the two groups in language fluency. East Asian Americans were performing equally well to European Americans in the hardest task (evidenced by overall accuracy scores), namely responding correctly to the background voice in the same gender focal + background task trials.

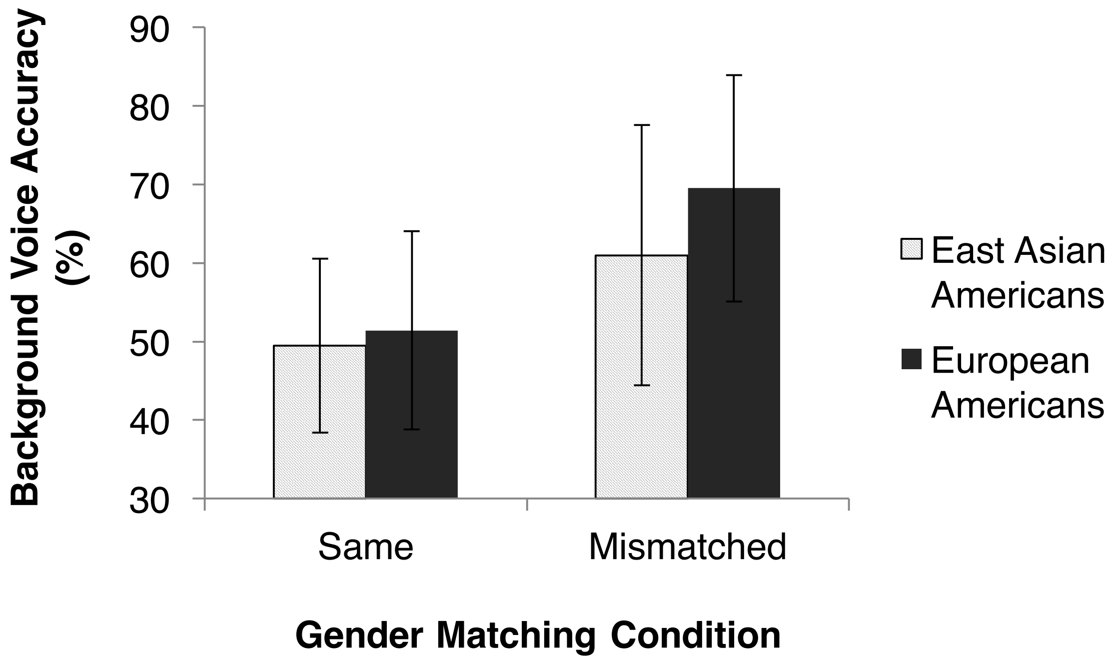

Figure 4. Interaction between gender of the paired speakers and culture on the accuracy rate of the background voice in the focal + background task, controlling for focal voice accuracy in the focal only task.

Alternative cultural explanation using holistic tendencies. Given the mixed findings of condition on task accuracy using self-identified ethnicity as the cultural moderator variable, I sought to create a cleaner test of the original hypothesis, using the measured variable of holistic tendencies. I had predicted that the cultural difference in attention between East Asian Americans and European Americans would be explained by a tendency towards holistic versus analytic tendencies. However, the measure of individual differences in holistic-analytic tendencies showed that East Asians Americans (M = 4.36, SD = .824) did not differ significantly from European Americans (M = 4.31, SD = 1.00), $t(157)$ = .314, p = .754. To examine the association between holistic tendency and task performance, I conducted a series of bivariate linear regression analyses predicting participants' performance score from their tendency to show a holistic cognitive style. Since these analyses tested the predictive power of the individual difference measure of holism, rather than cultural grouping based on self-identified ethnicity, I utilized the entire sample (N = 202) including non-East-Asian Americans as well.

First, to compare relative performance for the focal voice in the focal only task and focal + background task, I created a difference score subtracting focal voice accuracy in the focal + background task from focal voice accuracy in the focal only task.[3] Given that I expected the performance of holistic thinkers to be less harmed in the focal + background task, the prediction would be that more holistic thinkers would show a reduction in the difference score. The results revealed a marginally significant relationship holistic tendencies and relative accuracy, $t(201) = -1.64$, $p = .098$. Participants who scored higher on holistic tendencies tended to show less reduced performance in the focal + background task relative to the focal only task ($b = -1.49$, $\beta = -.117$).[4]

For the background voice in the focal + background task, results revealed a significant relationship between holistic tendencies and response accuracy $t(201) = 2.10$, p = .037. As predicted, participants who scored higher on holistic tendencies tended to respond more accurately ($b = 2.06$, $\beta = .143$).[5] The relatively reduced drop in performance for the focal voice in the focal + background task compared to focal only task, coupled with the increased accuracy for the background voice, for participants who showed greater holistic tendencies, provides tentative support that more holistic thinkers were able to broaden their

[3] A difference score was used, given the challenges of applying linear regression models to repeated-measure designs. I also analyzed the residuals and the pattern of results did not change.
[4] Gender was found to significantly predict holistic tendencies, such that males ($M = 4.57$, SD = .909) showed significantly higher holistic tendencies than females ($M = 4.25$, $SD = .833$), $t(200) = 2.279$, $p = .024$. Controlling for gender did not alter the direction of findings.
[5] Again controlling for gender did not alter the direction of findings.

attention across the two voices. In other words, the increased accuracy for the background voice did not come at the cost of decreased accuracy for the focal voice.

Discussion

The results of this study did not support my hypothesis that compared to European Americans, East Asian Americans would be relatively less harmed by the additional challenge of paying attention to a second simultaneous voice. East Asian Americans were less accurate overall than European Americans, regardless of whether the task required listening to one or both of two simultaneous voices. However, when using the individual difference measure assessing analytic-holistic tendencies, a pattern more consistent with predictions emerged. More holistic thinkers showed less difference in performance between the focal only task and focal + background task, when examining focal voice accuracy. Further, more holistic thinkers had increased performance for the background voice in the focal + background task, relative to less holistic thinkers. Culture grouping based on self-identified ethnicity was proposed as a proxy for holistic tendencies. However, groups in this sample did not differ in the individual difference measure of analytic-holistic tendencies as predicted, suggesting that ethnic background might be a poor grouping variable.

Further in Study 1, I found unexpected findings that the gender matching of the paired speakers impacted accuracy of performance – mismatched gender trials were easier for both East Asian Americans and European Americans, while same gender trials were more challenging. The qualitatively greater similarity between same gender voices might have increased the difficulty of separating the two voices. Regardless of task, East Asian Americans were less accurate than European Americans, perhaps explained by the lower number of native English speakers among the East Asian American participants. Surprisingly though, I found that East Asian Americans performed equally well in the most difficult condition – background voice in the focal + background matched-gender condition. One possible explanation for the equal performance of East Asian Americans and European Americans in this condition is that there is a floor effect on performance. However, as a conservative estimate of chance in this task, consider that even if participants are able to correctly identify the number, the odds of selecting the correct answer remain at 25% (1 out of 4 colors). Although the average accuracy in this condition (approximately 50%) appears well above this estimate of chance level, it might be that both East Asian Americans and European Americans were able to perform at a certain baseline accuracy even when the task became challenging.

Study 2

In Study 2 by manipulating the rank of the speaker, I investigated the impact of additional social factors on attention tendencies and whether culture might moderate the effect. This study involved the same social listening task as Study 1, except that the social rank of the speaker relative to the participant was manipulated. In the single voice trials, participants were introduced to two male speakers, identified as recorded from either a fellow student (equal ranking) or from a professor (higher ranking). The rank of speaker was crossed with the listening tasks, such that participants in some cases were asked to direct their attention to the professor voice, while ignoring the student voice, or vice versa – directing their attention to the student voice, while ignoring the professor voice. Based on cultural variation in emphasizing hierarchy, I predicted that speaker rank would have a stronger effect on response accuracy for East Asian Americans than for European Americans.

Regardless of cultural background, higher-ranking individuals tend to attract attention (Dalmaso, Pavan, Castelli, & Galfano, 2011; Foulsham, Cheng, Tracy, Henrich, & Kingstone, 2010). This effect emerges early in life – even young preschoolers are more likely to look to dominant individuals among their peers (Abramovich, 1976). Affording high-ranking individuals influence, through attention and deference, contributes to establishing order and facilitating cooperation among individuals (Bales, 1950; Berger, Rosenholtz, & Zelditch, 1980).

While attending to high-ranking individuals appears fundamental to human group organization, cultural factors may influence the formation and maintenance of social hierarchies. Specifically, the cultural dimension of power distance is relevant to understanding the organization of social hierarchies across cultures. Power distance measures the extent to which less powerful members of organizations accept and expect that power will be distributed unequally (Hofstede, 2010). Compared to Western countries, East Asian countries have higher power distance with an unequal distribution of power in society that is accepted and even emphasized. For example, Japanese students might use the title "*teacher*" when addressing their professor, rather than using given or family names. In contrast, low power distance cultures like the United States have decentralized power and flat organization structures. Any power differences that do exist tend to be deemphasized. For example, American students might address a professor by their first name. These cultural differences in power distance are evident in communication styles. Respect of elders and those who hold higher social status is emphasized in Japanese culture (Tsujimura, 1987). To show respect, the Japanese language has special expressions and words used exclusively towards superiors, (e.g., the verb "go" with standard form of "*iku*" is conjugated as "*irrasyaru*" for superiors).

This linguistic phenomenon distinguishing superiors from peers has no direct parallel in the English language. In interpersonal interactions, Japanese students are more sensitive to rank, using greater interaction distance with their professors than white American students (Engebretson & Fullmer, 1970).

Given that American culture deemphasizes hierarchy and power differences, I predicted that European American participants would not show any difference in accuracy when attending to a professor versus student voice. In contrast, East Asian Americans would show a difference in response, such that attention is more strongly drawn to the higher-ranking speaker voice compared to the equal-ranking speaker voice. (For specific predictions, see Tables 1 and 2.)

	Focal in Focal Only	Focal in Focal + Background	Background in Focal + Background
Student	↓↓	↓↓	↑↑
Professor	↑↑	↑↑	↓↓

Table 1. Rank by task predictions for East Asian participants in Study 2.

	Focal in Focal Only	Focal in Focal + Background	Background in Focal + Background
Student	↓	↓	↑
Professor	↑	↑	↓

Table 2. Rank by task predictions for European American participants in Study 2.

Method

Design and Participants

This study had a 2 (rank of focal voice: student, professor; within-subjects) x 3 (task: single, focal only, focal + background; within-subjects) x 2 (participant culture: European American and East Asian American; between-subjects) design. The full sample had 231 University of California, Santa Barbara undergraduate participants (73% female, M_{age} = 18.9, SD = 1.27), including 80 East Asian Americans (77% female, M_{age} = 19.3, *SD* = 1.35) and 88 European Americans (75% female, M_{age} = 18.7, *SD* = 1.19). East Asian Americans (i.e., those who identified themselves as from South Korea, Japan, or China) and European American participants were recruited based on their self-categorized ethnicity in pre-screening question. Among the East Asian Americans students, there were 41 Chinese, 13 Korean, 7 Taiwanese, and 4 Japanese. In addition, there were 5 participants of mixed race (including 2 Japanese/Filipino, 1 Japanese/Vietnamese, 1 Chinese/Taiwanese, and 1 Chinese/Vietnamese). Further, there were 14 unspecified students (e.g., "Asian"). Among the unspecified students, 9 reported being born in China and 3 reported being born in the United States (1 had parents born in China and 2 had parents born in South Korea). On the basis of self-reported birthplace and parental birthplace, the unspecified students were also included in our sample of East Asian Americans. In addition, there were 46 Asian Americans from non-East Asian countries (80% female, M_{age} = 18.8, *SD* = 1.15) from Vietnam (16), India (10), the Philippines (10), Burma (2), Laos (2), Thailand (2), Indonesia (1), Cambodia (1), and of mixed Vietnamese/German background (1). Finally, there were 30 participants from additional backgrounds including Lithuania, Brazil, Russia, Israel, Iran, and Croatia. Among the East Asian Americans, 37 were born outside the U.S., while 44 were born in the U.S.

Among the European American students, the majority was born in the U.S. (85 students) with only 3 students born outside the U.S. (specifically: 2 from the United Kingdom and 1 from Australia). In addition, I selected participants, who indicated in the pre-screening questionnaire that they had not been previously diagnosed with any hearing impairments. Participants were recruited through the Psychological and Brain Sciences Department participant pool (paid and credit). For their participation, participants received course credit (.5 credits) or monetary compensation ($5).

Materials & Procedure

Social auditory task. Upon arriving to the lab, participants were told that they would complete a simple listening task and answer a few basic survey questions. Participants were seated in front of a computer and asked to wear a pair of headphones. Further instructions were presented on the computer screen.

The same social auditory task was used as Study 1 with some modifications. In the Study 2 version of the task, only two male speakers were used from the original set of eight talkers (specifically talker 0 and 3). In the single voice trials, participants were introduced to the two male speakers, along with profile information on each speaker. As a cover story, participants were told that the study sought to investigate the effect of regional dialects on speech intelligibility. The cover story gave justification for providing information about the speakers. In feedback questions, no participants expressed suspicion about the cover story. The profile information included a photo of the speaker along with the fictional speaker's name, hometown, university affiliation, department affiliation, and role at the university. I told participants that they would hear voice recordings randomly selected from recordings I took of students and professors at University of California, Santa Barbara, as well as from students and professors at similarly sized state universities around the United States. In actuality, all participants were shown profile information for one fictional student and one fictional professor, both described as from the University of California, Santa Barbara. The student fictional profile identified the student as named “Alex,” from Los Angeles, and studying Communication at UC Santa Barbara. The professor profile identified the professor as named “Tom,” from Los Angeles, and teaching Economics at UC Santa Barbara. (See Appendix III for stimuli used for the profile information.) To avoid confounding speaker ethnicity with participant ethnicity, I randomly assigned participants to see either two male European American speakers, or two male Asian American speakers. Further, the pairing of recorded messages from the two talkers was fully crossed with role as professor or student, to avoid confounding talker with speaker role.

Following the same procedure as Study 1, participants first completed single voice trials although I reduced the number to 8 trials. In each trial, participants heard the recording (e.g., “Ready Charlie go to blue 7 now!”) and simultaneously saw the fictional profile information of that speaker on the computer screen. Participants were then instructed to respond by clicking on the corresponding color and number button in the same 32 button matrix used in Study 1. Following the single voice trials, participants completed four separate blocks of 15 trials each – focal only task with professor as focal voice, focal only task with student as focal voice, focal + background task with professor as focal voice, and focal + background task with student as focal voice – presented randomly. Again button clicks and response time in milliseconds were recorded. Accuracy was scored in the same way as Study 1, with 0 representing incorrect number and incorrect color, 1 representing either correct number or correct color, and 2 representing both correct color and correct number. Responses within each of the four blocks were averaged to yield a single accuracy score.

Questionnaires. After completing the auditory task, participants answered the following series of measures on a computer: the Analysis-Holism Scale, AHS (Choi, Koo, & Choi, 2007), the Brief Self-Control Scale, BSCS (Tangney, Baumeister, & Boone, 2004), items related to music training and ability, and demographics. The AHS includes 24 items designed to assess the extent to which individuals show analytic versus holistic thinking tendencies, focusing on the Locus of Attention subscale, which consists of 6 items, rated on a 1 (strongly disagree) to 7 (strongly agree) scale ($\alpha = .733$). Example items include, "*The whole, rather than its parts, should be considered in order to understand a phenomenon*" and "*It is more important to pay attention to the whole rather than its parts.*" Demographic questions included age, sex, place of birth, and language spoken at home. Participants answered the same English fluency and comprehension items used in Study 1 (see Appendix II), which were again averaged to create a composite measure of English ability ($r = .861$, $p < .001$). At the end, participants were thanked and debriefed.

Manipulation Check Questions. After the initial 8 single voice trials, participants were asked to recall information about the speakers. Participants were played a recording from both speakers and asked whether the recording came from student or professor. Participants were also asked about the university affiliation and department affiliation of each speaker. If participants incorrectly responded about the role of both speakers, then participants were asked to complete a second round of 4 single voice trials. At the end of the study, participants were again asked to identify the speakers from a voice recording as either the “student” or the “professor.” From the final analyses, 4 participants were excluded for failing both manipulation check questions.

Results

Given the ceiling effects found in Study 1 with the single voice condition, I excluded the single voice condition and conducted a 2 (rank of focal voice: student, professor; within-subjects) x 2 (task: focal only, focal + background; within-subjects) x 2 (participant culture: European American and East Asian American; between-subjects) mixed model ANOVA on task accuracy score. As predicted, there was a significant main effect of task, $F(1, 162) = 39.0$, $p < .001$, with all participants showing reduced accuracy in the focal + background task ($M = 60.8\%$, $SE = 1.25$) compared to the focal only task ($M = 69.0\%$, $SE = 1.41$). There was a significant main effect of rank, $F(1, 162) = 4.82$, $p = .030$. Contrary to predictions, participants were more accurate in the student condition ($M = 67.3\%$, $SE = 1.53$) compared to the professor condition ($M = 62.6\%$, $SE = 1.62$). Like in Study 1, there was a main effect of culture, $F(1, 162) = 18.5$, $p < .001$. East Asian Americans performed worse overall ($M = 59.9\%$, $SE = 1.65$) compared to European Americans ($M = 69.9\%$, $SE = 1.63$), regardless of the task. None of the two-way interactions were significant. There was no interactive effect between rank and task, $F(1, 162) = .254$, $p = .615$ and rank and culture, $F(1, 162) = .004$, $p = .950$. There was a marginally significant interactive effect of culture and rank, $F(1, 162) = 2.99$, $p = .086$. While European Americans performed equally well in both the professor and student conditions ($p = .729$), East Asian Americans performed significantly worse in the professor condition ($M = 55.7$, $SE = 2.31$) compared to student condition ($p = .006$), showing on average a 8.4% drop in performance. Finally, I found a marginally significant three-way interactive effect between rank, task, and culture, $F(1, 162) = 2.76$, $p = .099$. Although the three-way interactive effect between culture and rank was only marginally significant, I investigated the pairwise comparisons. Comparing performance in the student versus professor conditions, the accuracy of East Asian Americans showed as predicted more sensitivity to rank, specifically in the focal only task (p = .002), with decreased performance for professor voice (M = 58.6, SE = 2.70) compared to student voice (M = 69.5, SE = 2.60). The focal + background task showed only marginally significant differences by rank for East Asian Americans (p = .083). In line with predictions, the accuracy of European Americans showed no difference between student and professor conditions for either the focal only task (p = .944) or the focal + background task (p = .492). (See Figure 5.)

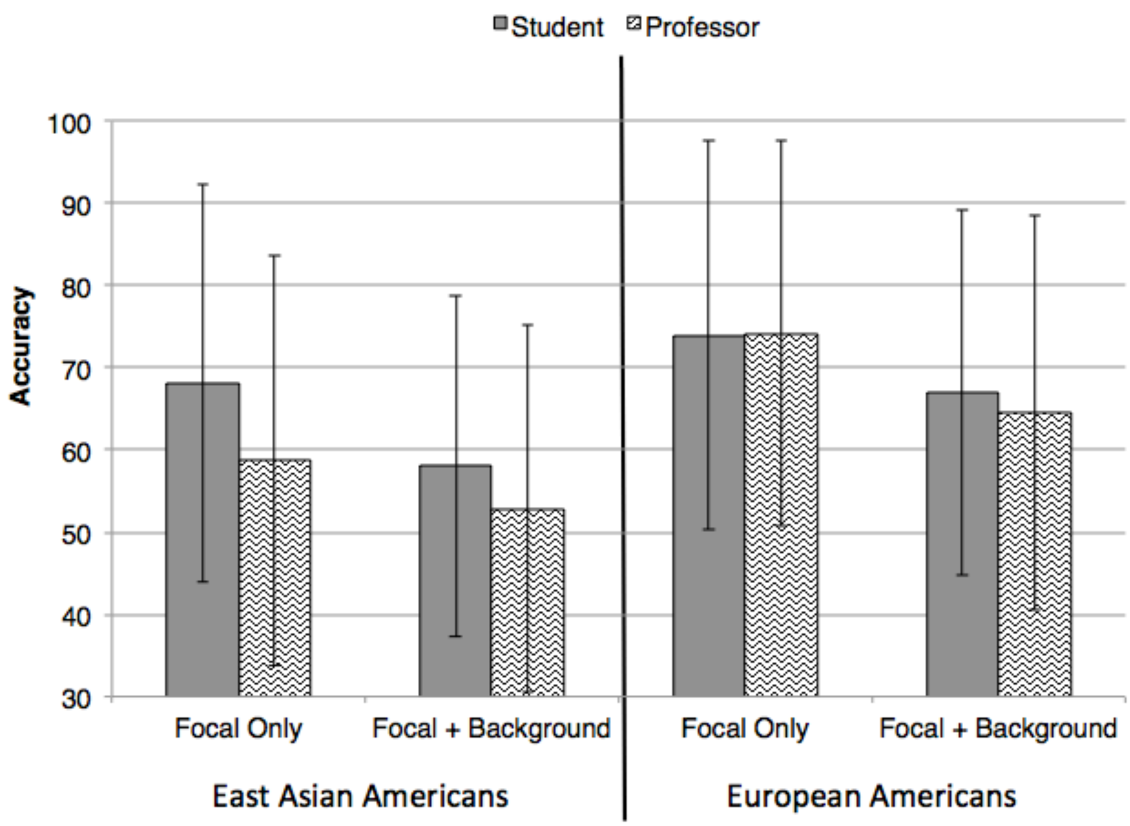

Figure 5. Interaction between culture, task condition, and speaker rank on accuracy rate.

To examine background voice accuracy, I conducted a 2 (rank of background voice: student, professor; within subjects) x 2 (participant culture: European American and East Asian American; between-subjects) mixed model ANOVA on task accuracy score. There was no significant main effect of rank, $F(1, 164) = 2.47$, $p = .118$. There was a significant main effect of culture, $F(1, 164) = 16.1$, $p < .001$. Consistent with Study 1, East Asian Americans were less accurate ($M = 52.1\%$, $SE = 1.65$) compared to European Americans ($M = 61.4\%$, $SE = 1.61$). There was no interaction between culture and rank, $F(1, 164) = .562$, $p = .455$. (See Figure 6).

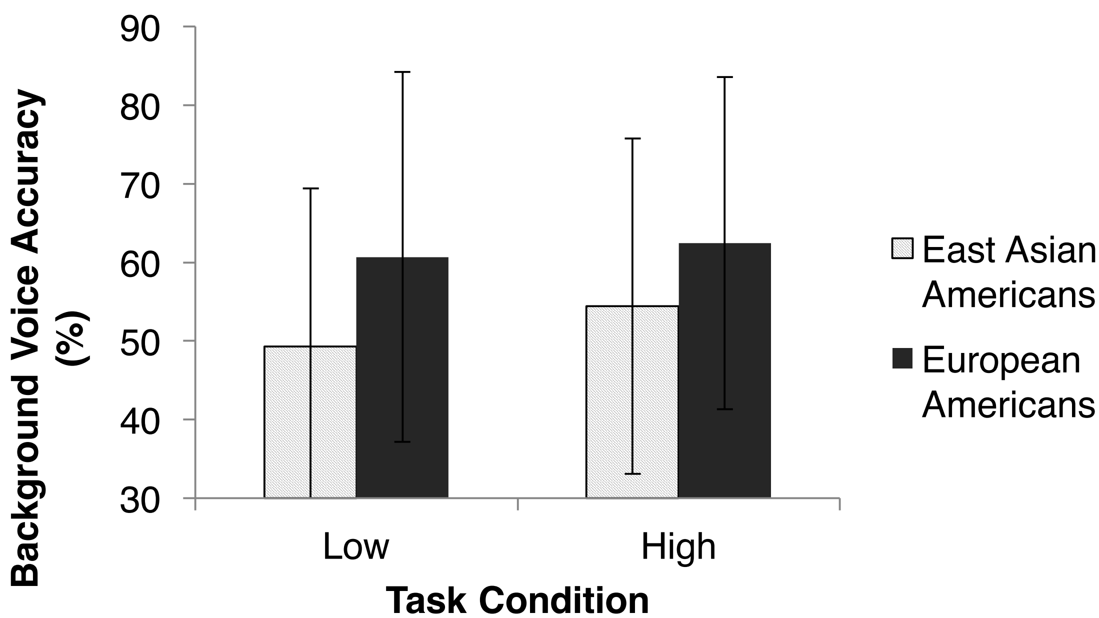

Figure 6. Interaction between culture and speaker rank on accuracy for background voice in focal + background task.

Like Study 1, English ability for East Asian Americans[6] positively predicted accuracy for the background voice in the focal + background task ($r(81) = .312$, $p = .005$), although

[6] Like Study 1, there was insufficient variance in the English fluency and comprehension items to test the correlation for European American participants.

only marginally in the focal only task ($r(81) = .197$, $p = .078$). Consistent with Study 1, English ability predicted background voice accuracy ($r(81) = .384$, $p < .001$).

Fluency effects with East Asian Americans. Similar to Study 1 to investigate the role of English fluency in the cultural differences, I limited the sample to the 44 East Asian American students who reported that they had been born in the United States and re-ran the key ANOVA analysis. I conducted a 2 (rank of focal voice: student, professor; within-subjects) x 2 (task: focal only, focal + background; within-subjects) x 2 (participant culture: European American and US-born East Asian American; between-subjects) mixed model ANOVA on task accuracy score. There was a significant main effect of task, $F(1, 124) = 28.282$, $p < .001$. There was no significant main effect of rank, $F(1, 124) = 1.258$, $p = .764$. There was a main effect of culture, $F(1, 124) = 4.587$, $p =.034$. East Asian Americans performed worse overall compared to European Americans. In the Study 1 fluency analyses, excluding East Asian Americans born outside the United States eliminated the group differences on task. However, in Study 1, even U.S.-born East Asian Americans still performed consistently lower than European Americans.

None of the two-way interactions were significant: task x rank, $F(1, 124) = .181$, $p = .671$; task by culture, $F(1, 124) = .091$, $p = .764$; and culture x rank, $F(1, 124) = .536$, $p = .465$. The three-way interaction of task x rank x culture was also not significant, $F(1, 124) = .441$, $p = .508$. The results from Study 2, where the group differences on task performance remained even when eliminating East Asian American born outside the United States, may appear inconsistent with Study 1findings that selecting U.S.-born East Asian Americans eliminated group differences. However, place of birth is only a single measure of cultural background. Other factors like language spoken at home, living environment, and even geographical location with differing exposure to culture could affect the individual's cultural background and language fluency. Indeed, comparing the demographics of the East Asian American sample from Study 1 and Study 2, the groups are similar expect that relatively more East Asian Americans in Study 1 report not using English at home. Those who were born in the United States may also have been more likely to use English at home.

Alternative cultural explanation using holistic tendencies. In Study 1, I found that using the individual difference measure of holistic tendencies was a better moderating predictor of task accuracy, compared to using self-identified ethnicity as the cultural grouping variable. In an attempt to replicate the Study 1 finding, I conducted a series of bivariate linear regression analyses following Study 1 procedures, predicting participants' task performance score from their tendency to show a holistic cognitive style.[7]

First, using the difference score[8] comparing focal voice accuracy in the focal + background task to focal voice accuracy in the focal only task, results revealed a marginally significant relationship between holistic tendencies and relative accuracy, $t(230) = -1.665$, $p = .097$. Participants who scored higher on holistic tendencies tended to show less reduced performance in the focal + background task relative to the focal only task ($b = -1.80$, $\beta = -.109$).[9] For the background voice in the focal + background task, results revealed no relationship between holistic tendencies and response accuracy $t(230) = -.588$, $p = .557$.[10] The findings from Study 2 did not fully replicate the pattern in Study 1. The individual

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[7] As in Study 1, holistic tendencies did not significantly differ by culture.
[8] Again, as in Study 1, a difference score was utilized. The pattern of results did not change, when using residuals as the dependent measure.
[9] Replicating the pattern from Study 1, male participants were significant more holistic ($M = 4.76$, $SD = 1.05$) than female participants ($M = 4.41$, $SD = .965$), $t(229) = 2.499$, $p = .013$. Controlling for gender did not alter the direction of findings.
[10] Again controlling for gender did not alter the findings.

difference measure of analytic-holistic tendencies did predict the relatively smaller reduction in performance in the focal + background task, compared to the focal only task. However, the earlier finding that more holistic thinkers were more accurate in responding to the background voice did not replicate in Study 2.

Discussion

The results provide partial support of my hypothesis that rank may differentially alter attention depending on cultural upbringing. I predicted that East Asian Americans, raised in a cultural environment that emphasizes roles and hierarchy, would show greater sensitivity to rank information about speakers, while European Americans would show less sensitivity. Overall, compared to European Americans, East Asian Americans had a tendency to show differential performance when they were asked to focus on the voices of high versus equal ranking speakers. European Americans did not show any statistical difference in performance based on speaker rank. However, the direction was opposite the prediction. East Asian Americans tended to show *decreased* performance when asked to focus on higher ranking speakers, compared to equal ranking peer speakers. Although I expected that the effect of speaker rank for East Asian Americans would be exacerbated in culturally mismatching task (i.e., the selective attention challenge in the focal only task), I did not find supportive evidence that the effect of rank depended on East Asians either attending narrowly in the focal only task or broadly in focal + background task. In Study 2, I did replicate findings from Study 1 that the individual difference measure of holistic tendencies predicted relative performance in the focal only task compared to the focal + background task. The accuracy of more holistic individuals, regardless of cultural background, tended to be less affected when dividing their attention between two simultaneous speakers.

The finding that East Asian Americans tended to be more accurate in responding to equal rank voices may appear contrary to the robust literature on the attention-grabbing effect of rank (Dalmaso, Pavan, Castelli, & Galfano, 2011; Foulsham, Cheng, Tracy, Henrich, & Kingstone, 2010), which occurs not only in human groups but animals as well. However, while significant evidence points to higher-rank individuals attracting greater attention, achieving higher rank is not always associated with greater influence and attention. Rank can be defined based on various characteristics relevant to hierarchies, including competence, dominance, and resources. The status dimension can affect whether rank attracts attention (Mattan, 2016). Further, when studying naturalistic gaze attention behaviors, individuals may actually avert their gaze away from higher-rank targets (Exline, Ellyson, & Long, 1975; Gobel, Kim, & Richardson, 2015).

Relevant to culture, I focused on how variation in accepting hierarchical power differences, the cultural dimension of power distance, might affect sensitivity to speaker rank. However, another relevant cultural dimension, confounded with power distance in the current study, is individualism/collectivism. East Asian countries tend to score high on both power distance and collectivism, while North American countries tend to score low on both power distance and collectivism (Hofstede, 1984). Collectivistic societies emphasize group membership, particularly distinguishing between relevant, close others in the in-group and less relevant, more distant out-group members. From a collectivistic orientation, East Asian American participants might have been particularly attuned to relevant in-group members, in this case the equal ranking speakers described as undergraduate students from UC Santa Barbara. In contrast, the professor might have been viewed as an outgroup member and thus would not have drawn attention.

General Discussion

Previous research on perception demonstrated that culture can influence even seemingly fundamental processes like attention (e.g., Masuda & Nisbett, 2001; Masuda & Nisbett, 2006). Existing work has solely relied on visual tasks. The present research sought to broaden understanding by extending research to listening. Cultural theory proposes that differences in underlying social orientations, traced to philosophical traditions and societal factors, account for the observed variation in perceptual processes like attention (Nisbett, et al., 2001). Given that attention appears to be a shared resource linking the senses (Hafter, Bonnel, Gallun, & Cohen, 1998; Buchtel & Butter, 1988; Driver & Grossenbacher, 1996), I expected to find similar cultural differences in attention across sensory domains. However, unlike the visual system, the auditory system takes in a broader range of stimuli and is less controllable. Thus, the auditory system may be outside the influence of sociocultural factors. Listening presents an important domain to rigorously test the theory of cultural influences on perception by altering attentional tendencies.

Summary of findings. Across two studies, my results did not show the predicted cultural differences in auditory attention. Both Study 1 and Study 2 showed a consistent main effect of culture, such that East Asian Americans had lower accuracy than European Americans regardless of the task. In particular, East Asians were expected to show a slight advantage in the task that required simultaneously attending to two voices. European Americans outperformed East Asians, even on the task that required dividing attention between voices. Further I expected that European Americans, theorized to have an analytic style of attention, would have lower accuracy for the background voice. Results from both studies showed the opposite pattern with European Americans responding with greater accuracy for the background voice compared to East Asian Americans. Contrary to all predictions, I did not find cultural differences with listening that paralleled previously findings with vision. One possible explanation is that the auditory system is relatively less controllable, and thus not be culturally penetrable in the same way as the visual system.

Although my findings were not consistent with cultural groupings, findings at the individual level tentatively suggest the possibility that holistic tendencies may play a role in auditory attention. Using the Analism-Holism scale (Choi, Koo, & Choi, 2007), designed to capture individual-level variability in holistic reasoning, I found that holistic tendencies did predict performance consistent with cultural patterns. In both Study 1 and Study 2, having greater holistic tendencies predicted relatively less distraction by the presence of additional background information. In other words, more analytic reasoning was associated with a greater drop in performance when simultaneously listening to both voices (*focal + background task*) compared to focusing on one voice (*focal only task*). Further, in Study 1, greater holistic tendencies were also associated with better accuracy for the background voice. Importantly, there was no corresponding decrease in accuracy for the paired focal voice, suggesting that holistic tendencies were associated with greater ability to broaden attention across multiple streams of auditory information. The individual difference measure of analism-holism conceptually replicated the basic pattern of previous findings with visual attention (e.g., Masuda & Nisbett, 2001; Masuda & Nisbett, 2006).

The research highlights the multi-faceted nature of culture by examining how an additional cultural dimension might influence attention. In Study 2, I manipulated the social rank of the speakers, and found that whether participants came from a cultural background in which status and hierarchy differences are emphasized influenced their pattern of attention.

For European Americans raised in a cultural environment that de-emphasizes power differences to create a flat social structure, information about the rank of the speaker did not affect accuracy. However, for East Asian Americans, who tend to come from a cultural background that emphasizes hierarchical differences, rank influenced accuracy. However, the pattern was opposite predictions – East Asian American participants afforded greater attention to lower-ranked targets (i.e., fellow undergraduate students) compared to higher-ranked targets (i.e., university professors).

Limitations. There are several limitations to the present research. The cultural groups based on self-reported ethnicity did not differ on the key variable of holistic tendencies. Further, ethnicity was confounded with English language ability, which strongly predicted accuracy for East Asian Americans. Also given that we included East Asian American students currently studying at University of California, Santa Barbara, participants would be expected to have acculturated to American culture to an extent. Thus, their responses may not represent prototypical East Asian cultural characteristics. In addition, my ability to assess behavioral outcomes was limited by a design issue that prevented accurate measurement of reaction time. Due to programming constraints, the page refreshed between the auditory file and the response matrix, reducing variance in response time. Instead, I used response accuracy as the key dependent variable, which might have been less sensitive to cultural variation than reaction time. Although I found performance differences between the high-ranking and low-ranking voices, especially for East Asians, the manipulation of rank might have been weak. Research suggests that high status voices sound qualitatively different than low status voices (Ko, Sadler, & Galinsky, 2014). In the current design, I manipulated profile information about the speakers but did not particularly select for voices that *sounded* either high or low ranking.

The paired sound file design of the social listening task presents a key limitation, especially when comparing to theoretical work on cultural differences in attention and previous research on visual attention. Earlier work highlights how Asian attention is drawn to the context, including the relationship between focal objects and background context. However, the current social listening task does not clearly have a focal focus with background context. Instead, the two audio files are simply simultaneously occurring information with no clear relationship. The lack of relationship means that little can be gained from integrating the two streams of information. Compare conceptually to the classic visual undersea task created by Masuda and colleagues (Masuda & Nisbett, 2001) with fish swimming in front of seaweed. Integrating that the contextual informational that the fish are in water arguably helps understand the scene as a whole. However, in my design, the two speakers are not related to each other in a meaningful way. One intriguing possibility is that for East Asians Americans accustomed to integrating multiple sources of information, the very lack of relationship between the steams of information proved an obstacle. Due to their holistic tendencies, the East Asian American participants may have been struggling to integrate the two disconnected voices and messages, and this helps account for the consistent cultural differences I found with East Asian Americans underperforming compared to European Americans.

Future directions. Research could address the unexpected finding that East Asian participants appeared to focus attention on the lower ranking speakers (i.e., other students) rather than on the professors. My reasoning focused on cultural differences in power distance between East Asian and North American contexts. However, power distance tends to be correlated with the additional cultural dimension of individual-collectivism, which is associated with greater emphasis on ingroup-outgroup distinctions (Hofstede, 2010). East Asian cultures tend to score higher on both power distance and collectivism, compared to North American cultures. Both dimensions may have played a role in accounting for why East Asians tended to focus on the voices of their fellow students. Collectivistic tendencies may encourage distinguishing between ingroup and outgroup, and power distance provided the category (namely rank) by which groups were divided. The current study cannot separate these two explanations. Future work could include cultures with divergent collectivism and power distance scores to examine the distinct influence of these cultural dimensions. Such research will demonstrate the importance of viewing culture as multi-dimensional. Culture is not a single dimension, and calls for sophisticated treatment when predicting psychological and behavioral outcomes across contexts.

Both the existing visual attention research and my research treat sensory domains as independent. However, an emerging body of research points to multisensory convergence within the brain (for review, see Shroeder & Fox, 2004). In particular, attention may account for some overlap between the senses. For example, attention to a stimulus in one sense can interfere with directing attention to a stimulus in another sense (e.g., Buchtel & Butter, 1988; Driver, 1996; Hafter, Bonnel, Gallun, & Cohen, 1998). Research in the cultural domain has not attempted to integrate tasks across senses. Existing work suggests that how attention is allocated between senses may vary consistently across cultures. In particular, Asians appear to emphasize auditory information, while Westerners favor visual information. For example, Westerners tend to show a strong McGurk effect, a phenomenon in which conflicting visual information interferes with the ability to accurately perceive speech (McGurk & MacDonald, 1976). When presented with a videotape of someone mouthing "*ga*" while simultaneously playing the sound of "*ba*," people tend to misinterpret the speech sound as "*da*" fusing the visual and auditory information. Both Japanese and Chinese show a weaker McGurk effect (Sekiyama, 1997; Sekiyama & Tohkura, 1993). The attention of East Asians seems to be particularly drawn to the emotional content of sounds. In a vocal Stroop task, Asians had greater difficulty ignoring vocal tone over verbal content (Ishii, Reyes, & Kitayama, 2003). When shown facial expressions paired with emotional utterances, Japanese more strongly weighted vocal cues to make emotion judgments, compared to Dutch participants (Tanaka, Koizumi, Imai, Hiramatsu, Hiramoto, & de Gelder, 2010). The design of my social listening task focused on auditory information but by nature of the programming, simultaneously presented visual information. From the results, it is not clear how these two channels of information may have competed for attention differently across cultures. In debriefing, most participants reported that they closed their eyes to focus during the task. Future work could examine the interplay between multiple senses to better understand cultural influences on attention more broadly.

Understanding how differences in the environment contribute to variation in perception and attention presents another direction of future work. The Japanese visual environment is more ambiguous and complex compared to corresponding American scenes (Miyamoto, Nisbett, & Masuda, 2006). Further, viewing photographs of Japanese scenes caused both Japanese and American participants to attend more to contextual information, compared to viewing American scenes. The physical environment may directly foster cultural differences in attentional patterns. To date, no systematic study of naturalistic sounds across cultures and the effect of those differences on attention has been attempted. However, from research comparing the visual perceptual environments of East Asia and North American (Miyamoto, Nisbett, Masuda, 2006), the prediction is that sounds might be more distinctive and stand out from the background more in a North American environment compared to an Asian environment. Speaking anecdotally, a traveler to Asia will likely notice that many public spaces in Japan are noisier with a greater mix of sounds. Retail stores, like pharmacies and grocery stores, commonly have multiple layers of sounds with customers talking, music playing, and sellers shouting into microphones advertising special discounts. Speakers may even be mounted directly onto shelves playing advertisements and contributing to a dense soundscape in which sounds are difficult to separate from each other. Using noise levels as an indication of soundscape complexity, Japanese pachinko parlors can reach a deafening 92 decibels (Tolentino, 2009), while the ambient volume in gambling locations in Las Vegas are at a comparatively modest 70-80 decibels (Las Vegas Noise Survey, 2010). The online global collaborative sound map – Radio Aporee (radio aporee ::: maps, 2006) – which allows users to upload recordings of their environment, may offer one method to begin sampling soundscapes across cultures.

Finally, research could consider the health implications of cultural differences in attentional processes. Hearing plays a critical role in social connection and well-being. The loss of hearing is associated with increased negative mood and impaired social functioning (Appollonio, Carabellese, Frattola, & Trabucchi, 1996). Vision loss is also linked to negative social well-being outcomes, like feeling lonely and left out. However, this sense of isolation occurs with even mild hearing loss (Stark & Hickson, 2004), highlighting the critical role that hearing plays in social interaction and well-being. Restoring hearing helps reduce anxiety

(Joore, Potjewijd, Timmerman, & Anteunis, 2002), improves social functioning (Mulrow et al., 1990), and improves quality of life not only for the individual experiencing hearing loss but for their significant other as well (Stark & Hickson, 2004). Even without hearing loss, sounds in our environment have the ability to negatively impact health. Among nations, Japan ranks 47th for noise pollution and the U.S. ranks 44th (Nation Master, 2014). Harsh and loud sounds in the environment have been linked to disruptions to fetal growth (Edmonds, Layde, & Erickson, 1979), decreased learning ability in children (Bronzaft & McCarthy, 1975), and a range of stress-related diseases like cardiovascular disease (Stansfeld & Matheson, 2003). Further, the ways that culture specifically influences attention may manifest in the attention-related symptoms of certain mental diseases. The positive symptoms of hallucination with schizophrenia have been linked to disruptions to selective attention processes (Morris, Griffiths, Le Pelley, Weickert, 2013). However, hallucinations show marked variation across cultures, a pattern potentially linked to cultural variation in attentional processes (Bauer et al., 2010).

Conclusion. In the present research, I built upon previous work showing that culture can influence perception by altering patterns of attention. I considered the new domain of listening to examine whether those differences generalize across sensory domains. My findings did not support predictions at the cultural group level. Holistic tendencies enforced by culture do not appear to play a role in auditory attention as expected. At the individual level, I did find that differences in holism predicted an attentional advantage to attending to multiple sounds at the same time. However, these individual differences could not be traced back to sociocultural factors, as the cultural groups did not consistently vary on holistic tendencies. Results did show that basic auditory attention appears to be influenced by cultural factors, but the specific cultural dimension – individualism/collectivism or power distance – is not clear from the findings. Existing work showing that culture can influence even basic perceptual processes was exciting and hinted at the ways in which the mind is flexible and can be altered across cultural contexts. However, my findings did not replicate theorized results. The influence of culture on attention may be unique to vision, which itself is unique among our senses, and more limited than theory would suggest.

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Appendix I.

Audio files used in Study 1.

			Call Sign	**Color**	**Number**	**Total**
Single			*Charlie*	Any	Any	**15**
Paired	Male/Male	Target	*Charlie*	Any	Any	**12**
		Distractor	Not *Charlie*	Not Target	Not Target	
	Female/Female	Target	*Charlie*	Any	Any	**11**
		Distractor	NOT *Charlie*	NOT Target	Not Target	
	Male/Female	Target	*Charlie*	Any	Any	**37**
		Distractor	Not *Charlie*	Not Target	Not Target	

Appendix II.

English Comprehension and Fluency Items from Study 1 and Study 2.

Please assess your English language – COMPREHENSION.

(1) At a slow speed, I can understand the main points of short dialogues but not all the details. Some repetition may be necessary.
(2) I can understand most of what is said in longer dialogue. Repetition may be needed but only for abstract concepts.
(3) I can understand everything at a normal speed with only occasional repetition.
(4) Native level. No barriers to comprehension.

Please assess your English language – FLUENCY.

(1) I can express myself with simple language, but often hesitate especially when expressing more complex ideas.
(2) I am generally fluent with only occasional lapses when searching for the natural manner of expression.
(3) I can effortlessly express myself but occasionally hesitate to search for less-common words.
(4) Native level. No barriers to fluency.

Appendix III.

Speaker Rank Manipulation from Study 2

UCSB Professor

Name: Tom
Dept: Economics
Hometown: Los Angeles, CA

UCSB Student

Name: Alex
Dept: Communication
Hometown: Los Angeles, CA

UCSB Professor

Name: Tom
Dept: Economics
Hometown: Los Angeles, CA

UCSB Student

Name: Alex
Dept: Communication
Hometown: Los Angeles, CA