THE EFFECT OF MACROCULTURES AND MICROCULTURES ON VISUAL PERCEPTION

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ABSTRACT

Culture is defined as the social transmission of ideas, arts, knowledge, and languages (Mish et al, 1993; Pickett et al., 2006; Jewell & Abate, 2001). Psychological research often overlooks small distinct cultures such as Deaf and Video Game cultures by focusing on macro-level categorizations. The current literature review assesses both macrocultures and microcultures in terms of different aspects of visual perception. Differences in optical illusion perception, peripheral vision and motion processing, spatial, and facial perception among people from typical mainstream cultures and Deaf and Video Game cultures are discussed. It is argued that the more immersed and involved in a culture an individual is, the more experience he or she gains with certain events and activities. Culture thus informs perceptual, cognitive, and countless other experiences. Future studies are recommended to further examine how microcultures affect different psychological and physiological processes.

INTRODUCTION

At the core of the field of psychology lies a controversy between whether behaviors are biological and therefore universal across cultures, or whether they result from physical and social environments that are culture-specific (Adamopoulos & Lonner, 1994). Studies attempt to examine differences in perception, cognition, emotion, and other facets across cultures in order to understand what aspects are, in fact, universal (Adamopoulos & Lonner, 1994). However, even in studies that explicitly consider culture, there are limitations. Cultural studies typically examine behaviors in terms of macro-level cultural variables such that individuals are categorized as either "Western" or "Eastern," or the individual's home country is used as a proxy for their culture (Cohen, 2009). This oversimplification ignores the important role of arguably more influential micro-level cultures. To explore this issue, this paper will demonstrate the utility of studying psychological processes in the context of specific micro-cultures. This will be done through an examination of perceptual processes within two microcultures: Deaf Culture and Video Game Culture.

Culture: Defined

Defining *culture* involves both objective and subjective perspectives. A person can subjectively define culture through a qualitative account of feelings, opinions, and identifications. At the same time, culture can be objectively defined as the a group of people's distinct ideas, customs, social norms and behaviors, and general way of life that is passed down through generations (Mish et al, 1993; Pickett et al., 2006). It is a collective account of arts and knowledge of a large group of people (Jewell & Abate, 2001). A key component of culture is the physical world that engulfs the people living in it, which is typically examined at an international level.

A major limitation of current culture research is the tendency to overgeneralize from narrow samples (Henrich, Heine, & Norenzayan, 2010). Past research has made claims that Western cultures view certain optical illusions in the same way as people from non-Western cultures; perception of visual illusions were hypothesized to be universal (Henrich, Heine, & Norenzayan, 2010). However, a cross-cultural examination showed that there are distinct differences in the perception of the Muller-Lyer Illusion (Henrich, Heine, & Norenzayan, 2010). In addition, looking at Western culture alone is not satisfactory; within the United States, significant differences in optical illusions existed between hearing and deaf individuals with schizophrenia (Horton & Silverstein, 2011). It is not enough to examine cultures in the grander scale, but also less observed, smaller cultures such as Deaf culture. Lesser recognized cultures will from this point forth be referred to as *microcultures.* These will be defined as separate cultures contained within a larger mainstream culture, or *macroculture.* Microcultures should not be confused with *subcultures*, defined as a cultural groups within a true culture (Jewell & Abate, 2001). These distinct and unique cultures are not simply cultural groups deviating from the norm, but rather authentic categories that affect individuals regardless their macroculture. With this in mind, the present literature review focuses upon two microcultures: Deaf culture and Video Game culture. Consistent with Padden & Humphries (2005), this paper will use *Deaf* to refer to the people that make up the Deaf society and *deaf* to indicate the physiological condition of hearing loss. Similarly, *Video Game* will be capitalized when referencing the unique culture created by engaging in digital games, whereas lowercase *video game* will refer to the actual game itself.

Culture is vulnerable and subject to change over time; a culture is created and greatly affected by smaller interacting components (Fiske, 2002). Cohen (2009), however, defines culture on a more micro-level. Religion, socioeconomic status, and geographic regions can be considered their own distinct cultures, rather than simply cultural aspects contained within a larger [true] culture (Cohen, 2009). Cohen (2009) argues that religion is itself a culture because it has its own practices, language, and is transmitted over time. Aspects that have previously been considered part of a culture can now be considered their own individual culture. For example, even though a Christian person living in a beach-town in California, a Muslim person living in a rural area in Kentucky, and a Jewish person living in New York City are all American, they have vastly different religious relationships and geographical interactions. In most research in psychology, even that which uses a cultural lens, these people would be grouped together under the guise of "Americans" even though they share completely different values and experiences and are exposed to vastly different terrains. Cohen (2009) argues that such a broad categorization misses important contextual differences that exist between people *within* a particular macro-culture. Moreover, "Western" and Eastern" cultures can vary dramatically. The United States has different values, practices, and beliefs than Canada, and Canada's customs are completely different from those in the United Kingdom and Greece. In past research, all of these countries have been grouped together as Western nations, even though the culture contained within each individual country is different in potentially important ways.

Microcultures Worth Examining

Two microcultures that are potentially related to perceptual processes are Deaf and Video Game cultures. These microcultures have their own language, contain social norms and expected behaviors, and have a collection of arts, all of which are passed on through generations. Deaf culture, for example, uses sign language as the main mode of communication; this language is passed on from one generation of Deaf individuals to the next. To be part of a Deaf culture, one must be knowledgeable of a signed language; both deaf and hearing members characterize the Deaf community (Padden & Humphries, 2005). In addition, people are expected to follow certain social norms. When walking between two hearing people speaking to one another, one would simply say "excuse me," walk around the interlocuters, and continue their path. When walking between two Deaf people who are signing, one must form the correct sign (EXCUSE-ME) and walk *between* the two signers (Padden & Humphries, 2005). It is important to be visually salient and make one's presence known, as to not startle the deaf individuals.

Deaf and Video Game cultures have members that share certain values, experiences, and beliefs. The people of the Deaf community have struggled to gain rights and acknowledgment for at least half a century. In the United States, ASL was first recognized as having true linguistic properties in 1965 when William Stokoe wrote *A Dictionary of American Sign Language on Linguistic Principles.* In the time preceding its publication, ASL was stigmatized and thought of as a last resort if oral training for the deaf proved ineffective (Neisser, 1983). Once Stokoe analyzed the semantic and syntactic properties of sign language, ASL became a recognized language. It is the past struggle to use their natural language that makes deaf (and hearing) signers unite under a larger Deaf community. Similarly, VGP were ridiculed initially when people did not understand the lure of video games (Wolf, 2012). VGP were able to bond with one another not only over a common interest, but also by feeling like they were in a safe place with people who understood their desires.

Consistent with the definition that culture is a collection of arts, the Deaf community values the art of humor (Sutton-Spence & Napoli, 2012). The Deaf community uses humor as not only a means to bring people together and create an in-group atmosphere, but also to outline cultural rules, regulations, and teach lessons (Sutton-Spence & Napoli, 2012). Rogoff (2003) reports similar findings from non-Western cultures. An Apache woman recounted going to a family function where her grandmother told all the partygoers about an Apache man who "acted white" and was ostracized from the village (Basso, in Rogoff, 2003). The woman internalized this underlying message of the importance of staying true to the Apache culture and left the gathering to change into authentic attire. Similarly, Deaf norms and appropriate social behaviors are perpetuated through humorous stories and jokes.

Video Game culture also has art, history, language, norms, and ideals are transmitted over time. Dedicated players form an identity, acquire knowledge, and measure individual success by game performance (Shaw, 2010). By this definition, people who play video games consider themselves part of a broader community. The games themselves involve art, as people must create certain images within the game. Conducting a basic Google Image search, one can view a myriad of Video Game caricatures. The more immersed one is within a Video Game culture, the more realistic the artworks become. Additionally, Video Game culture also has its own language. Someone who plays World of Warcraft (WoW) in the United States can easily bond with someone who plays WoW in China. An American WoW player may use the term *guild* to refer to joining a certain group within the game, or *pwn3d* to refer to dominating another player in digital combat (Wach, 2014). Only another WoW player would understand; the language used in the game itself separates players from non-players. Even within the same country, a non-player would not understand the linguistic context of a player who used game terminology in conversation.

Linking Culture and Perception

Perception has historically been studied as a biological process. The eyes perform essential functions in order for a human to visually perceive his or her external environment. There is an area within the retina that contains two kinds of photoreceptors, *rods* and *cones.* Both types of photoreceptors work to translate electromagnetic energy into changes in retinal membrane potential, a process that enables a human to perceive the world visually (Lauwereyns, 2012). Rods enable rough vision such as outlines of shapes and light and dark differences, and cones enable color vision and more fine-tuned capacities. The cones congregate mostly in the *fovea,* or the center of the retina. This section allows for clear vision, and is the center of the visual field. Just outside of this area, the *parafoveal region*, one perceives outlines and general details of shapes and motion, but not crystal-clear visual and color as one would in their central visual field. Stimuli in a person's immediate environment affect all of these parts to visual perception.

Masuda (2010) posits that the environment and thinking styles affect perception among cultures. The Carpentered Environment Hypothesis suggests that the physical environment contributes to the variability observed in visual perception. People base their visual perspectives on learned geometrical and physical aspects of their surrounding environment (Masuda, 2010). Optical illusions, for example, demonstrate how visual characteristics of an individual's environment affect perception. The Müller-Lyer Illusion features two identical lines with arrows pointing in opposite directions on either side. Individuals from Western cultures tend to incorrectly view the lines as different lengths, due to the placement of the arrows at the ends of the lines. In a cross-cultural examination, individuals from non-Western cultures were not fooled by the seemingly different-sized lines (Masuda, 2010; Henrich, Heine, & Norenzayan, 2010). These differences are linked to culture in that the only people who were not fooled by the illusion were from non-Western cultures, whereas individuals from a Western society were deceived by the picture. It is possible that people living in cultures without angular buildings or emphasis on horizontal and vertical lines do not perceive objects and images in the same way that a person from a Western culture, with perpendicular buildings and orthogonal angles would (Masuda, 2010).

Another common theory assessing differences among cultures in visual perception is holistic versus analytic thought processing. Holistic processing refers to focusing attention on an entire area and relationships between objects in context-dependent scenarios, while analytic processing is localized attention on salient individualized objects embedded within a larger context (Masuda, 2010). Eastern cultures tend to stress a holistic approach while Western cultures emphasize an analytic perspective (Masuda, 2010). In a rod and frame test, participants from both China and the United States were instructed to set a rod inside of a box in a vertical position when the box was vertical as well as when it was tilted. American participants made almost zero errors, whereas Chinese subjects demonstrated great difficulty in completing the task (Masuda, 2010). It is hypothesized that because Chinese individuals come from a culture that emphasizes holistic thought, these subjects perceived the task as a whole, rather that two separate pieces, and thus could not break a single image apart. American culture adopts an analytic cognitive perspective, which focuses attention to salient details contained within larger settings. It is further hypothesized that American subjects did not struggle at all with this task because they were able to easily tease apart the rod from the box, since they perceive localized details (Masuda, 2010).

Perhaps people from Eastern cultures (like the Chinese participants in the above example) not only perceive images as single objects, but also that their central visual field is larger in order to accommodate many images contained within a larger scene. Certain microcultures may adopt this strategy. Deaf culture, for example, uses signed languages as a key component of the entire microculture (Padden & Humphries, 2005). When signing, one must look not only at a face, but also hands, body shape, and direction of movements (Emmorey, Thompson, & Colvin, 2008). This creates a larger visual region of interest that a person attends to while communicating. Because signers gain more experience allocating their visual attention and perception to a greater area of space, it is conceivable that Deaf culture emphasizes a more holistic and global visual processing approach. Video Game culture may also reflect a more holistic view. Vallett et al. (2013) had video game players (VGP) and non-video game players (NVGP) view the classic Simons and Chabris (1999) video of people playing basketball with a man in a gorilla suit walking through during the game. Typically, participants are unaware that a man in a gorilla suit walks across the screen, while they attend to their given visual task. Results from Vallett et al. (2013) revealed VGP noticed the gorilla significantly more often than their NVGP counterparts. This suggests that perhaps video games require players to divide their visual attention and distribute it across a larger field. People who are part of a video game culture may adopt a more holistic and global visual attention span.

Deaf culture and Video Game culture can greatly influence individuals, conceivably more so than macrocultures. The aforementioned attentional differences between VGP and NVGP exist within a Western (American) culture. It is not enough to separate people by Western or Eastern culture, but rather whether they are VGP or not. The same idea applies to people who are part of the Deaf community. A Deaf individual often acts differently than someone who is not part of the Deaf culture but part of the same macroculture. The current literature review examines differences among individuals in terms of visual perception at the cultural level. Both macro- and microcultures are assessed to determine the impact of different kinds of culture on perception of optical illusions, spatial, facial and emotional, and peripheral visual perception.

OPTICAL ILLUSIONS

Macrocultural Account of Optical Illusions

A common misconception is that falling victim to optical illusions is universal (Henrich, Heine, & Norenzayan, 2010). More recent investigations of this topic suggest that being fooled by such illusions is culture-specific. Figure 1 depicts the Müller-Lyer Illusion, a famous illusion that has been shown to individuals living in many different cultures (Appendix A). The lines are in actuality the same length, but the arrows on the end give the illusion that one is longer than the other because they are pointed in opposite directions. When shown this image, individuals from Western cultures are fooled and indicate that the line on the left is bigger, but people from Tribal cultures (e.g. Murray Islanders in Melanesia and Toda tribe in India) see the lines as equal (Masuda, 2010; Henrich, Heine, & Norenzayan, 2010).

One compelling theoretical explanation for these distinct perceptual differences is the Carpentered Environment Hypothesis (Masuda 2010; Henrich, Heine, & Norenzayan, 2010). This theory posits that perception of shapes and structures is dependent upon past experiences with a physical environment (Masuda, 2010). People living in Western cultures, for example, are surrounded by buildings and structures that are constructed of angles and straight edges. Over time, viewing these man-made structures creates a biased visual perception such that people are more attuned to variations in angles and lengths of objects (Henrich, Heine, & Norenzayan, 2010). A person from the United States will not be surprised or as amused when looking at a skyscraper as a member from an African tribe; a US citizen sees buildings on a daily basis whereas the African tribe member does not. Since people from Western cultures are heavily exposed to such geometric oddities, they learn to interpret two congruent lines as different lengths on the basis that the ending angles dictate depth, as they would in their three dimensional world (Masuda, 2010). African tribe members, on the other hand, perceive the identical lines as the same length, regardless of the differences in opposing angles, presumably due to lack of exposure to such angular depth cues.

Microcultural Accounts of Optical Illusions

While there are distinct differences in visual illusion perception between some macrocultures, there exist peculiar differences among microcultures. It is possible that the neurological networks in deaf individuals typically reserved for auditory processes may be reorganized for enhanced visual processing (Neville et al., 1998). Under this logic, deaf individuals may perform differently on tasks involving perception of visual illusions than hearing individuals. The research in this area is mixed, with some researchers claiming deafness has no effect on optical illusion perception and other disagreeing (Flaherty & Moran, 2007; Horton & Silverstein, 2011). Flaherty and Moran (2007) investigated whether there were differences between Deaf signers and Hearing non-signers in terms of left or right visual field advantages and accuracy in overcoming the presented visual illusion. The authors presented pairs of shapes to hearing and deaf participants who were instructed to indicate via button press which shape, of the pair, was a trapezoid. Both shapes (a square and a trapezoid) had angled parallel lines inside of them, and a special pair was created where the square appeared as a trapezoid, thus creating the visual illusion. Results were inconclusive; there was a significant right visual field advantage across all participants, and there were no significant differences between Deaf and Hearing participants (Flaherty & Moran, 2007). This right visual field advantage is compelling, as there appears to be these types of advantages among Deaf people but not Hearing non-signers in other facets, discussed later in this paper.

These results are informative, yet other studies show the opposite effect. Horton and Silverstein (2011) examined differences between Deaf and Hearing individuals within the schizophrenic population. Schizophrenics, compared to non-schizophrenic individuals, perceive local isolated qualities rather than contextually dependent details. When presented with images, they tend to focus in on salient details at a more extreme level than non-schizophrenic individuals. Because they are hypersensitive to minute details, this enables them to see pieces of an impossible image (rather than perceiving it as a single whole image) and easily see inconsistencies. (Horton & Silverstein, 2011). According to this logic, neurotypical individuals (those without schizophrenia) are easily fooled by optical illusions, whereas schizophrenic people easily detect salient details that forces them to see the illusion for what it is (and are not tricked by the illusion) (Horton & Silverstein, 2011).

Deaf and Hearing individuals with schizophrenia were shown variations of the Ebbinghaus visual illusion, which is made up of two main circles embedded within either a matrix of small circles or large circles. Figure 2 depicts the Ebbinghaus illusion used in the study (Appendix A). In this study, the center target circles were varied so that half the time the target circle was two percent larger when embedded in a smaller circle array, and half the time it was two percent bigger when embedded in a bigger circle matrix. Even though the circle was slightly larger when contained within a series of larger cirlces, neurotypical individuals typically respond erroneously, claiming the circle contained inside of smaller circles is bigger than the circle contained inside of larger circles (Horton

& Silverstein, 2011). Horton and Silverstein (2011) tested both deaf and hearing individuals with schizophrenia to examine if there were differences within the schizophrenic population. Hearing schizophrenics were not fooled by the illusion and made significantly fewer errors than Deaf schizophrenics, who made approximately the same amount of errors as a neurotypical individual would (Horton & Silverstein, 2011).

Deaf individuals use a visuospatial language daily (a language that relies on visual aspects and movement in space) and due to lack of auditory input, focus extensively on visual context (Emmorey & McCullough, 2009). Within the schizophrenic population, Horton & Silverstein (2011) argued that Hearing individuals outperformed Deaf individuals because Deaf individuals typically take the surrounding context into account because they rely on solely visual perception and attention (with no auditory input) and thus are fooled by the illusion because they perceive more of the illusion. Hearing schizophrenic individuals tend to be more attuned to local aspects, and are able to selectively ignore the surrounding circles to correctly perceive the salient target. Results supported the notion that Deaf individuals utilize more contextual information than Hearing individuals in the schizophrenic population because accuracy levels were significantly higher for Hearing than Deaf, suggesting Deaf schizophrenics, similar to the Hearing neurotypical population, take the surrounding circles into account when judging the target (Horton & Silverstein, 2011).

This study is direct evidence that within a Western culture, a Deaf culture affects visual perception of certain optical illusions arguably more so than the macroculture it is contained within. Both Hearing and Deaf people with schizophrenia participated from a psychiatric rehabilitation agency in the United States; all subjects were conscious of the cultural environment they were living in, yet those who identified as Deaf and used American Sign Language (ASL) performed differently than the Hearing patients. While using a vulnerable population to strengthen this argument may be unconventional, all other variables were equal: the only difference between the Deaf and Hearing groups in this study was hearing loss (Horton & Silverstein, 2011). It is possible to conclude that the existing differences between groups stem from the fact that the Deaf individuals come from a Deaf culture while the Hearing individuals do not. These marked differences in visual illusion perception within a Western culture suggest it is not feasible to group all individuals living in the United States, for example, into a Western ideal, but rather organize and categorize people by relevant microcultures.

The mixed literature regarding Deaf visual perception of illusions leaves much to be desired in this field. What is it about Deaf culture that affects perception of these optical illusions? Defining characteristics of Deaf culture are either being deaf or having knowledge of a signed language (Padden & Humphries, 2005). However, there are physiological factors that are linked to individuals in this culture. Codina et al.'s (2011) work showing changes in neural rim volumes between deaf signers and hearing non-signers gives evidence of physiological changes that can occur due to experience with a signed language. Using a Goldmann Perimetry task, participants had to respond to a flashing dot of light as it moved around to different parts of varying eccentricities of their peripheral and central vision. Codina et al. (2011) used Optical Coherence Tomography (OCT) to assess changes in neural rim structures (part of the optic nerve head). Behavioral results revealed that deaf signers had significantly larger peripheral fields than hearing non-signers. Deaf participants were able to successfully attend to more flashes of light in more extreme parts of their peripheral vision as compared to the hearing non-signers. It was not specified whether the deaf participants were more accurate in the right or left peripheral visual field, but rather that overall they were more accurate regardless of which side they were attending. The deaf signing participants also showed different patterns in the depth of their retinal nerve fibre layer (expanded fibers from the optic nerve) compared to the hearing non-signers, indicating more intricate differences at the nerve fiber level (Codina et al., 2011). It is possible that these intricate physiological differences between Deaf and Hearing individuals account for differences in visual perception, particularly of illusions.

While there are a limited number of visual illusion perception studies using Deaf participants, there are currently no known studies using Video Game players. A thorough investigation of video game playing and optical illusions employing 113 online databases and virtual libraries (e.g. Ebrary), 1 academic search engine (scholar.google.com), and searching physical books at the Sojourner Truth Library at the State University of New York at New Paltz, yielded minimal results. There were no studies investigating differences in visual illusion perception between video game players and non-video game players. The only pertinent research for the present literature review involved *Game Transfer Phenomena,* or video game elements permeating into real-life situations for members of the Video Game community (Ortiz de Gortari, Aronsson, & Griffiths, 2011). Ortiz de Gortari et al. (2011) performed a qualitative examination of just how playing video games affects real-life experiences. Presumably, the more immersed one is within a Video Game culture, the more of an impact that game will have on an individual's life. Subjects who reported spending hours a day playing video games also reported vivid illusory experiences, where they would "see" a game element when looking at a real-life object (Ortiz de Gortari, Aronsson, & Griffiths, 2011). Based on this evidence, it is plausible to argue that there would be an impact of playing video games on perceptual performance regarding optical illusions. If elements of the games affect perception of real life events, it is plausible that paying attention to such subtle details within a game affects visual perception of shapes and figures in other realms. Further research is necessary to substantially support or refute these proposed claims.

Microcultural Differences in Peripheral Vision

When signing, a signer must be able to perceive motion quickly and attend to details that are outside of their central area of vision. Signed languages are visuospatial; there is more emphasis on visual attention rather than auditory attention. While there may be many different aspects that contribute to how a person perceives the world, knowing a signed language can affect peripheral perception. When signing, there exists a larger perceptual span because one must look not only at a face, but also hands, body shape, and direction of movements (Emmorey, Thompson, & Colvin, 2008). An argument could be made that having experience with a signed language increases peripheral awareness. The more a person is involved in Deaf culture, the more they rely on signing. Through extensive experience, it is possible that belonging to a Deaf culture fosters enhanced peripheral visual perception.

If a person is not a native signer but desires to belong to a Deaf culture, they must learn the country's sign language (e.g. American Sign Language is the recognized sign language in the United States, but British Sign Language is recognized in England). To investigate how learning a signed language affects visual processing, Emmorey et al. (2008) compared deaf native signers to hearing non-native signers in visual tasks. Beginning signers were defined as individuals who had completed 9 to 15 months of ASL instruction or 3-5 classes, with 6-hour class time per week. Deaf native signers were congenitally deaf and used ASL on a daily basis. Both groups watched a confederate sign two different narratives in ASL while eye gaze was tracked. Results showed there were no differences between the deaf and hearing signers in terms of the amount of time they spent focused on the signer's face. This suggests that even signers with minimal experience are comparable to native signers for fixation times. There were differences, however, in gaze location; hearing non-native signers tended to focus more on the narrator's mouth, and deaf signers focused more on the eyes. While novice signers shifted their gaze away from the narrator's face more often than deaf signers (to look at the narrator's hands as he or she was signing), it was only for the narrative that involved describing locations within an imaginary town. The other narrative, describing a personal story, did not have any differences in gaze shift away from the narrator's face. This suggests that non-native signers shift gaze to a signer's hands specifically for spatial descriptions or stories that rely on differences in locations. It is possible that native signers do not shift their eyes as much because they have more experience paying attention to their periphery than beginning signers. This increased reliance and attention to peripheral visual fields for sign language suggests that more proficient signers possess a broader *perceptual span*, or the distance between fixation point and where the signed signal appears outside of this central visual field (Emmorey et al., 2008). The authors posit that understanding sign language in general requires visual perception and attention to unpredictable and dynamic visual movements, a lot of which happens outside of a central fixation point (p. 241). It is evident that the early stages of learning a signed language, the beginning signer must learn to fixate on a central point, but be increasingly aware of his or her periphery. This being said, beginning signers fixated more on the narrator's mouth than the deaf native signers, but the narrator tended to mouth words more often when signing to the beginning signers than the deaf native signers. This was an unforeseen confound to the study and for future comparisons involving beginning signers, the materials should be more standardized.

Signed languages place emphasis on movement; the direction of movement can change the meaning of a sentence. The direction (left to right, higher to lower, etc.) of signs can show verb agreement, a subject, and a predicate in a sentence. The concept of movement and motion is thus vital for sign comprehension and production. In a seminal study, Loke & Song (1991) compared deaf signers and hearing non-signers on a peripheral motion detection task and found that deaf signers were more accurate and faster than non-signers. The deaf signers were part of a Deaf culture, whereas the Hearing subjects were not. These results demonstrate the deaf signers' reliance on ASL to communicate and to maintain their cultural status. Similarly, Neville and Lawson (1987) compared deaf signers, hearing native signers, and hearing non-signers in a peripheral motion detection task. Results showed that deaf and hearing signers showed a right visual field (RVF) advantage and hearing non-signers showed a left visual field (LVF) advantage for detecting motion in their periphery. Because both deaf and hearing signers exhibited a RVF advantage, it is logical to conclude that this RVF advantage can be attributed to experience with a signed language as opposed to strictly auditory deprivation (if it was only auditory deprivation then the *hearing* signers would not show this visual field asymmetry). Both of these groups were members of the Deaf community; hearing signers were fluent and acquired ASL early in development because one or both of their parents were deaf. There appears to be clear differences in peripheral motion processing between members of Deaf culture and those who are not a part of it.

These RVF advantages linked to experience and proficiency with a signed language has also been replicated by others using a Stochastic Motion Display task

(Bosworth & Dobkins, 1999; 2002; Bosworth, Petrich, & Dobkins, 2013). Participants (deaf signers and hearing non-signers, 1999; deaf and hearing signers and hearing non-signers, 2002) were presented a field of dots on a computer screen and instructed to focus on a central fixation point. The dots in the background proceeded to move a in a coherent manner, either to the left or right. There were "distractor" dots moving in random directions in the background as well. Participants had to respond correctly to the direction of movement of the majority of background dots (those moving in a coherent manner). Again, both deaf and hearing signers showed RVF advantages while hearing non-signers exhibited LVF advantages. These data show that even with a different motion detection task, there is still a commonality between deaf and hearing signers in terms of visual field asymmetries. It is also important to note that this suggests that sign language experience explains the RVF rather than auditory deprivation. If it was solely due to auditory deprivation, hearing native signers would not exhibit the RVF advantage. The Deaf culture is marked by the use of a signed language and thus people who are proficient are more closely linked to the culture.

Training with a signed language affects peripheral motion processing performance, even if it is learned later on in life. Evidence from other domains suggests training can, in fact, affect performance if the skill is learned later in life. Pascual-Leone (2001) gave non-musicians training on a piano and measured both behaviorally and neurologically what happened during the training session. After only 2 hours a day for 5 days the amount of errors participants made were significantly lower on Day 5 from Day 1. In addition, there was significantly more cortical activation in the trained hand than the non-trained hand after each training session. Likewise, there was significantly more cortical activation for the trained hand by Day 5 than from Day 1. This study shows that with very little training, there can be behavioral and even neurological changes that occur in neurotypical individuals. Applying this finding to the microcultures discussed in this paper, even people who have not belonged to the culture for long can still be affected by it.

Green and Bavelier (2003) compared Video Game Players (VGP) to Non-Video Game Players (NVGP) in a series of visual attention tasks to determine whether playing video games can alter visual peripheral attention and perception. Across five tasks (flanker task, enumeration task, stimulus size and presentation time decreased, attentional blink task, and training) VGP outperformed NVGP; the VGP were more accurate and faster at detecting target stimuli. In the final task, training, Green and Bavelier (2003) set out to determine whether peripheral discrimination was better for VGP because they played video games or whether people with naturally better peripheral detection were more likely to play video games. The researchers took a group of NVGP and gave them a training session (1 hour a day for 10 days) in either an action (*Medal of Honor*) or non-action (*Tetris*) video game. Those that played the action game improved on all of the visual attention tasks they were given (Green & Bavelier, 2003). This gives more support for the claim that experience or training with a certain skill will enhance peripheral discrimination, even with very little amounts (here, only 10 hours total). Therefore, even if members of a Video Game culture have not belonged for that long, they are still undoubtedly affected by that microculture.

Deveau, Lovcik, and Seitz (2014) tested NVGP before and after video game training on central and peripheral acuity discrimination tasks as well as a contrast sensitivity task. Results showed an overwhelming improvement across all measures in the after-game condition (Deveau, Lovcik, & Seitz, 2014). Participants were more accurate in perceiving stimuli in their central visual field and in their periphery. In addition, participants' ability to distinguish between finer and finer increments of light and dark stimuli (contrast sensitivity) increased, post-training. Presumably, the more training one has, the greater the effects (in this case benefits) in the visual perceptual domain. If a person self-identifies as a member of a Video Game culture, the individual will participate in playing video games; after prolonged immersion in the game, their vision will be affected as well.

Buckley et al. (2010) compared four groups of participants (VGP, NVGP, deaf signers, hearing non-signers) on the Goldmann Kinetic Perimetry optometric test to determine how training and auditory deprivation affect peripheral visual fields. Similar to previous research, VGP were more accurate than NVGP and deaf signers were more accurate than hearing non-signers in peripheral discrimination. However, when comparing the two group's peripheral vision, the VGP had a much more uniform distribution of vision whereas the deaf signers were more asymmetrical and oblong. This suggests that different mechanisms are responsible for peripheral enhancements based on the type of training or experience one receives. While the Deaf participants had experience using a signed language, the VGP had experience playing video games; these are not the same kind of stimulation and thus it is possible that the shape of one's peripheral visual field is dependent on the type of training he or she receives, which in turn is dependent on culture.

Macrocultural Differences in Spatial Perception

Differences in spatial perception among cultures can be explained by differences in cognition, which are informed by culture. Typically, as argued previously, people in Western cultures tend to adopt an analytically determined cognition where a focus is placed on localized salient objects (Nisbett & Miyamoto, 2005). Alternatively, Eastern cultures typically endorse a holistic cognitive style where emphasis is placed on relationships and other contextual factors (Nisbett & Miyamoto, 2005). Masuda (2010) posits that cultures perceive objects in space differently, based on whether they engage in a holistic or an analytic thinking style. In a study examining macrocultural differences in color and spatial perception, East Asians were faster and more accurate than Western participants in detecting color changes when colored squares were expanded outward from the initial fixation point (Boduroglu, Shah, & Nisbett, 2009). The participants from an East Asian culture adopted a more holistic thinking style, and were able to encode the entire study screen, rather than simply focusing attention on specific details. These subjects were able to accurately perceive colors and shapes when target squares were moved outward, while Western participants tended to accurately perceive and respond to the same stimuli in smaller visual fields. The authors conclude that people from an Eastern/Asian culture are able to focus their visual attention more broadly than people from a Western culture (Boduroglu, Shah, & Nisbett, 2009). In a second experiment, the authors shrunk the target squares into an even smaller central visual field (Boduroglu, Shah, & Nisbett, 2009). In this condition, Western participants were more accurate than East Asian participants when responding to targets. The researchers postulate that it is because the thought process of people in a typical Western culture is analytic in nature and specific details remain intact when shrinking a visual field.

Similar results have been found by Ishii, Tsukasaki, & Kitayama (2009). Japanese and American participants were shown a cue for an image and had to make a perceptual judgment about the original image. The figure was masked in one of two ways: either the participant was given an analytic cue, where only one or more piece(s) of the image were shown, or the participant was given a holistic cue, where the entire image was shown, but blurred out. Figure 3 shows an example of an intact stimulus, with different methods of masking the original image (Appendix B). Americans performed significantly better than Japanese participants when exposed to analytic cues, whereas there was no difference between groups for the holistic cued condition (Ishii, Tsukasaki, & Kitayama, 2009). Even after replicating this experiment using more controlled conditions, results failed to reach significance in the holistic cueing condition (Ishii, Tsukasaki, & Kitayama, 2009). While the task of this experiment may not be measuring spatial perception per se, its attempts to uncover the mechanisms responsible for spatial perception make it worth noting. For instance, if one perceives an object embedded within a background, it is expected that making inferences about objects should be easier if the whole object and background are shown, however blurry they may be. The results from Ishii, Tsukasaki, and Kitayama (2009) suggest that this may not be the case. Perhaps analytic cues facilitate object recognition for people in analytic cultures, but holistic cues neither speed nor hinder performance in either macroculture. These mixed results are unclear and suggest that further research is needed to assess just how people from different macrocultures perceive objects.

Geographic Location and Spatial Perception

The ability to perceive and understand an object's geographic location is different from culture to culture. Li and Gleitman (2002) argued that cultures possess different languages, and it is the qualities of the language itself that determines how people understand where an object is in space. For example, Gumperz and Levinson (1996) claim it would be impossible for a person to name an object as "in front of" them, if there are no words for "in front of" contained within their language. They would refer to the geographic location of that object as "North" instead. A person from a culture that *does* use a language with the words "in front of," however, *would* describe the object as being at a geographic location in front of them. The type of culture one is embedded within affects the linguistic properties used to describe objects' spatial location.

Cultures can have different language systems that are either *egocentric*, where a person describes objects in relation to him or herself, or *allocentric*, where a person describes objects in relation to other landmarks or coordinates (Li & Gleitman, 2002). While a person from the United States would perceive a building as being to the left of the supermarket, a person from a Tenejapan village in Mexico would perceive the same building as being *uphill* (Brown & Levinson in Li & Gleitman, 2002). In this Non-Western tribal village, their language does not possess the words "left" or "right;" they simply say something is either "uphill" or "downhill" from something else. Previous literature in this domain has utilized the Animals in a Row Task, which has a participant view three toy animals on a tabletop, then turn to a different table and after being handed the same toy animals in a random order, replicate how they were originally placed (Li & Gleitman, 2002). Figure 4 depicts the Animals in a Row Task (Appendix B). Participants from an allocentric culture (i.e. Tenejapan Mayan villagers from Mexico) placed the animals on the second table in exactly the same cardinal direction (e.g. North) but participants from a Western culture (Dutch) placed the animals in the same relative direction they were facing when the participant viewed them from the first table (e.g. left of *themselves*) (Li & Gleitman, 2002). This difference in spatial perception appears to be a function of culture. The Dutch culture's language adopts a relative, egocentric, linguistic system where items in space are left or right of one another and everything is described in terms of a first person perspective. The Tenejapan culture's language adopts an absolute, allocentric, linguistic system where items in space are determined using a cardinal direction. Under this perspective, even though a person physically turns and has a new relative position, the cardinal directions remain constant. This explains why people from a culture that uses an allocentric language positioned the animal toys differently than people from a culture that uses an egocentric language.

Interestingly, Li and Gleitman (2002) were able to create an atmosphere where American subjects were able to adopt an allocentric viewpoint. The researchers ultimately concluded that this type of spatial reasoning can be modified when participants are given specific landmark cues. However, Levinson et al. (2002) argue directly against this idea, claiming that while it may be possible to prime subjects to respond certain ways, a culture's language is a key factor for initially determining how one views objects in space. Because past research has used country as a proxy for culture it is important to examine within culture differences to tease apart influences of *culture* from *language.*

Microcultural Differences in Spatial Perception

Deaf culture presents an interesting example of this general idea. When signing, interlocuters must perform mental rotations to adjust for the fact that the person signing is telling a story from the first person perspective, not the interlocuter's perspective (Emmorey, Klima, & Hickok, 1998). Emmorey et al. (1998) conducted two experiments, both manipulating whether deaf signers and hearing non-signers needed to perform mental rotations to correctly understand descriptions of objects in a room. Results from both experiments demonstrated that deaf signers were more accurate when objects were described from the narrator's perspective and significantly better than hearing subjects when mental rotations were required (Emmorey, Klima, & Hickok, 1998). While a typical American culture emphasizes an egocentric viewpoint, Deaf signers adopt a perspective that forces the conversation partner to rotate the signers descriptions; in a Deaf culture, an interpersonal viewpoint is utilized where interlocuters must take the signer's perspective into account.

Deaf and hearing signers are able to generate and rotate mental images significantly better than hearing non-signers (Emmorey, Kosslyn, & Bellugi, 1993). In a series of three experiments, deaf and hearing signers (both a part of an American Deaf culture) as well as hearing non-signers were briefly shown figures on a computer screen. They were asked to mentally maintain the image after it disappeared, remember aspects about the image, and then determine whether or not two simultaneously shown shapes were the same (Emmorey, Kosslyn, & Bellugi, 1993). Results revealed that participants who belonged to a Deaf culture had faster reaction times and were more accurate generating mental images. Subjects who were part of a Deaf culture also demonstrated superior abilities at detecting and evaluating mirror images of an original shape for the mental rotation task (Emmorey, Kosslyn, & Bellugi, 1993). These results suggest that people within a Deaf culture show significant differences in spatial processing when compared with people outside of that microculture. Because both deaf and hearing native signers showed enhanced abilities at generating mental images and discriminating different mental rotations, it is not necessary auditory deprivation that accounts for these differences, but rather being a part of a Deaf culture.

Congenital deafness is not the only factor responsible for the difference in spatial reasoning between hearing and deaf people. Parasnis, Samar, Bettger, and Sathe (1996) investigated the spatial perception of deaf children from India who were born deaf but not exposed to any signed language. India places emphasis on oral training for the deaf; teaching and learning signed languages is looked down upon and speech training and lip reading is heavily stressed (Parasnis et al., 1996). Parasnis et al. (1996) investigated if deaf children performed differently than hearing children on several spatial ability tests. Because the deaf children in India (where this study took place) were not exposed to a signed language since Indian culture stresses oral training, it sheds light on whether *only* auditory deprivation is linked with potential differences in spatial skills, as opposed to experience with a signed language, a defining characteristic of Deaf culture. When given a series of five spatial skills tasks, deaf subjects performed no differently than their matched hearing peers (Parasnis et al., 1996). This is direct evidence that a physiological difference (i.e. lack of the ability to hear) is not the root of potential spatial differences between deaf and hearing participants; instead, it seems more likely that the immersion within a Deaf culture, which includes the use of a visuospatial language, may account for differences in visual perception between hearing non-signers and deaf signers.

Research on Video Game culture also demonstrates differences in spatial perception between VGP and NVGP. Feng, Spence, and Pratt (2007) examined VGP compared to NVGP in their spatial attentional abilities. Both groups of participants were given a Uniform Field of View task that required them to correctly detect and identify a target after being masked. Figure 5 shows the sequence of stimuli from the Uniform Field of View task that was used (Appendix C). The VGP correctly detected and remembered spatial locations of targets faster and more accurately than NVGP. In a follow-up experiment, the researchers tested NVGP before and after only ten hours of video game training. Participants completed a Uniform Field of View task as well as a Mental Rotation task that instructed them to mentally move and make judgments about three dimensional figures (Feng, Spence, & Pratt, 2007). When compared to a control NVGP group that did not receive any video game training, the experimental group performance improved on all spatial perceptual measures. Similar to Green and Bavelier's (2003) results from their peripheral motion processing study mentioned earlier, it was specifically training with action video games that enhanced spatial abilities in subjects (Feng, Spence, & Pratt, 2007). It becomes evident that there is some quality about action video games in particular that is associated with enhanced spatial abilities.

Exposure to video games can affect one's spatial abilities (Subrahmanyam & Greenfield, 1994). Child subjects (ten years old) were given exposure to either a video game requiring spatial manipulations (Marble Madness) or a videogame that did not require spatial skills (Conjecture). Subjects who played the video game involving spatial abilities scored significantly higher on spatial aptitude tests than those who played

Conjecture (Subrahmanyam & Greenfield, 1994). Participants who performed suboptimally before training gained the largest improvements, but specifically for those who played Marble Madness. These results suggest that more experience playing video games that depend on spatial skills can enhance general spatial abilities, including aspects unrelated to the game itself (Subrahmanyam & Greenfield, 1994). While there were gender differences found (i.e. males outperforming females) there were differences in experience playing video games prior to the experiment; males spent significantly more hours playing video games than females, and scored significantly better than females on pretest assessments. Perhaps male children were more immersed in the Video Game culture prior to experimentation and already had enhanced spatial abilities for this reason. One must study NVGP in order to isolate the effect of the video game itself on spatial capabilities.

Okagaki & Frensch (1994) investigated how experience playing video games can affect spatial skills in NVGP. After training NVGP with the game Tetris, participants were given a battery of spatial skill assessments (Okagaki & Frensch, 1994). All subjects' scores improved after training on measures of perceptual speed, mental rotation, and shape comparisons. While males demonstrated a larger effect than females on the first task, a second experiment revealed that gender differences were only present when target objects were complex. In both experiments, training with a video game lowered reaction times and increased accuracies in most spatial tasks across genders (Okagaki & Frensch, 1994). People more involved in a Video Game culture will undoubtedly have more experience and training with their video game of choice and presumably have better spatial abilities than people who are not part of a Video Game culture. Enhancements in spatial abilities are linked with differences in spatial perception. Because VGP perceive objects in space differently than NVGP, they can make different (in this case more accurate) judgments about those objects. Being a member of a microculture, more so than a macroculture, can thus affect spatial perception.

FACIAL PERCEPTION

Macrocultural Differences in Facial Perception

There are marked differences between macrocultures for facial and emotional facial perception. Thinking style influences the way in which people process faces. Blais et al. (2008) showed Western and East Asian subjects a series of faces and, after familiarization and recognition phases, asked participants to categorize the race of the faces shown. The stimuli consisted of either Caucasian or Asian faces and participants had to respond in a binomial fashion. In addition, eye tracking software was used to determine where participants looked. Consistent with the *Own Race Bias*, Western participants were more accurate in naming races from their own culture (Caucasian faces) and Eastern participants were more accurate in naming races from their culture (Asian faces) (Blais et al., 2008). More importantly, results demonstrated that across both races of the stimuli, participants from a Western culture fixated mostly on the eyes of the stimuli while participants from an Eastern culture gazed mostly on the noses (Blais et al., 2008). The authors postulate that this distinct difference between groups could be explained by culture; Eastern participants come from a culture that contains a social norm of gaze avoidance, whereas Western participants come from a culture that emphasizes direct eye contact (Blais et al., 2008). Moreover, people from Eastern cultures adopt a holistic thinking style while those from Western cultures assume an analytic perspective. Blais et al. (2008) claims Westerners may have been utilizing one specific detail of the face (the eyes) to make judgements, whereas the Easterners may have fixated on a central point in order to take in the face as a whole. The type of cognitive viewpoint accepted by the different cultures informed the way the participants perceived the faces.

Microcultural Differences in Facial Perception

Deaf culture, contained within different macrocultures, has an effect on members' facial perception. Members within the Deaf community make certain facial expressions at specific points when signing; the use of one's face conveys grammar while signing, and is imperative for successful communication (Baker and colleagues in Pyers & Emmorey, 2008; Grossman & Kegl, 2006). Signers thus have more experience paying attention to faces than people outside of the Deaf culture, and there is a definite influence that can be seen. Hearing signers have been shown to produce ASL-appropriate facial expressions when passively viewing signed sentences (Pyers & Emmorey, 2008). Even when the signer is not physically signing, he or she still perceives the facial expressions that one would need to use. Additionally, when hearing signers were speaking English sentences, they also made ASL-related facial expressions (Pyers & Emmorey, 2008).

Perhaps due to this heavy reliance on facial processing for communication, there are marked differences between Deaf and Hearing cultures in eye gaze on faces. When shown a series of faces and asked to make simple judgments, Hearing and Deaf participants demonstrated different visual fixations (Watanabe et al., 2011). Deaf subjects fixated more on the eyes of the stimuli faces, whereas Hearing individuals tended to fixate on the center of the face (the nose) (Watanabe et al., 2011). Consistent with previous literature, all participants were Japanese and unsurprisingly, tended to fixate on the nose. Typical subjects from an Eastern culture adopt a holistic view and may fixate on a central area to encompass the entire face; the nose is in the center of the face so by fixating on this region, one can use peripheral vision to perceive the entire face (Blais et al., 2008). Watanabe et al. (2011) also claim it is possible that the Hearing subjects come from a culture that does not condone direct eye contact, and typical hearing individuals will avoid looking in someone's eye to abide by such cultural norms. However, Deaf individuals were also from a Japanese culture and looked longer and more frequently at the eyes of the static faces shown (Watanabe et al., 2011). The authors claim that because eye contact is vital for successful communication in Deaf cultures, that cultural norm overruled the appropriate macrocultural expectation. Deaf culture therefore impacts facial expression more so than an individual's macroculture.

After thorough research among hundreds of online databases and search engines, there are no known studies regarding differences in general facial perception between VGP and NVGP. There are expected differences, given that video games contain people in them, so the more an individual is immersed within that culture, the more faces they will see on a daily basis. On the other hand,video game graphics are not as finely detailed as a physical face; video game faces are not as expressive as a human face, due to technological constraints within the game's programming. VGP may be at a deficit for facial analysis and perception because they gaze at artificial faces more frequently than actual people's faces. Thus, more research in this field is necessary to understand the underpinnings of Video Game culture on facial perception.

EMOTIONAL FACIAL PERCEPTION

Macrocultural Differences in Emotional Facial Perception

The previous section discussed general facial perception; differences can be seen among macrocultures as well as microcultures in terms of discriminating among faces and eye gaze location. However, in a similar body of research, individuals from a myriad of cultures have been studied to examine whether there are differences in perceiving the emotion conveyed in faces. Typically, there is a universal ability to detect emotion via facial expression between Western and non-Western cultures (Ekman & Friesen, 1971). When prompted with emotionally-charged stories, people from a non-Western culture in New Guinea were able to successfully select the appropriate "Western" facial expression corresponding to the story (Ekman & Friesen, 1971). Results from this study as well as countless subsequent replications suggest that determining emotion from facial expressions is universal.

Additional research has attempted to pinpoint fundamental facial locations where emotional information is ascertained. Bassili (1979) found that observers fixate on either the top or bottom half of a human face, depending on which emotions are displayed. Participants more accurately interpreted an emotional facial expression using the bottom half of a face than the top half for sadness and fear, but were more accurate naming happiness, surprise, anger, and disgust when shown the top half of a face versus the bottom (Bassili, 1979). When participants were shown the whole face depicting an emotion, subjects showed high levels of accuracy, and appropriately selected the correct displayed emotion across all emotional conditions (Bassili, 1979). This suggests that a face in its entirety not only contains important regions that depict an emotion, but also holistically may contain surrounding clues that are helpful in emotional perception. For instance, subjects accurately selected “happiness” for a face displaying the emotion of happiness ninety percent of the time when the top half of the face was shown, but ninety-seven percent of the time when the entire face was displayed (Bassili, 1979). While the top half may contain the most important visual information for emotional facial perception, the face as a whole contains supporting information that makes emotional facial perception more accurate.

Microcultural Differences in Emotional Facial Perception

Emotional facial perception can also be viewed from a microcultural perspective. Letourneau and Mitchell (2011) investigated differences between Deaf individuals compared to Hearing subjects for a facial perception of emotion task. All participants were shown whole faces, the top halves, and the bottom halves of faces and asked to identity each face and then categorize the displayed emotion via button press (Letourneau

& Mitchell, 2011). Both groups of participants combined showed more accuracy when identifying and classifying emotions of faces when shown the whole face compared to a section (half) of it, as well as better accuracy for the top half of faces than the bottom half (Letourneau & Mitchell, 2011). However, Deaf participants were significantly less accurate in judging emotion using only the top half of the face compared to Hearing participants. In addition, when shown whole faces, Deaf participants focused on the bottom half of the face significantly more often than Hearing subjects (Letourneau & Mitchell, 2011). Members of Deaf culture may adopt a more holistic approach such that when they are shown pieces of a whole, they will less successful than hearing subjects in correctly identifying the depicted emotion. The Hearing subjects were quite accurate in naming emotions when only shown the top half of the face, which suggests a more analytic approach was utilized; these participants were able to hone in on local aspects and easily make judgments.

Differences between Deaf and Hearing cultures in terms of emotional facial perception can also be seen in visual field biases. Aforementioned studies involving peripheral motion processing show Deaf subjects demonstrate a right visual field bias (Neville & Lawson, 1987; Bosworth & Dobkins, 1999; Bosworth & Dobkins, 2002; Bosworth, Petrich, & Dobkins, 2013). Letourneau and Mitchell (2013) examined possible visual field advantages between Deaf and Hearing participants when shown emotional facial expressions. When presented faces in the right, left, or both visual fields, both groups of participants were most accurate in identifying emotions when presented faces in both visual fields (Letourneau & Mitchell, 2013). Typically, advantages can be seen for faces presented in the left rather than the right visual field but Letourneau and

Mitchell (2013) found that while this was true of Hearing subjects, Deaf participants showed reduced left visual field effects. Deaf individuals performed the worst when faces were presented in the left visual field and were most accurate when stimuli appeared in both visual fields (Letourneau & Mitchell, 2013). The authors postulate that Deaf culture places different visual demands on its members than Hearing culture does; this explains the shift away from a left visual field bias. It is further hypothesized that Deaf individuals rely not only on properties of a human face alone, but also on their direction of visual attention (Letourneau & Mitchell, 2013). Future research is necessary to explicitly examine how Deaf culture and experience using a signed language influence emotional facial perception.

Video Game culture also impacts emotional facial perception. Kirsh and Mounts (2007) randomly assigned participants to play either a violent or nonviolent video game, then had all participants judge a series of faces as either happy or angry. Participants who played a violent video game were significantly faster and more accurate when identifying angry faces than participants who played a nonviolent video game (Kirsh & Mounts, 2007). The intensity of the emotions displayed on the face stimuli were varied, such that some faces were less angry than others. Even among less intense emotional expressions of anger, the participants who played the violent video game beforehand were still more accurate and faster in their emotional judgments (Kirsh & Mounts, 2007). Action video games that typically contain violent aspects are extremely popular among VGP presently and constitute a large portion of the current Video Game culture. It is possible that VGP immersed in a Video Game culture are better at focusing on expressions of anger above all other emotions than NVGP. While Kirsh and Mounts (2007) shed light on such an issue, more research is necessary to determine whether people already in a Video Game culture have lasting effects on emotional facial perception.

DISCUSSION

As argued in this paper, research supports the idea that visual perception is influenced by both macrocultures (i.e., broad, mainstream cultures) and microcultures (i.e., narrowly defined cultures). Typically, culture research examines differences among larger-scale Eastern and Western cultures in terms of different perceptual process. For example, people from Eastern cultures perceive images in a large visual field and take in information contextually, while Western cultures focus their visual attention on smaller salient objects in a scene (Masuda, 2010). While this research is critical to our understanding of psychological processes, researchers have begun to recognize the importance of studying microcultures (Cohen, 2009). This paper reviews the literature on visual properties using both a macro and micro-cultural lens.

This paper outlines three main ways in which culture influences visual perception. First, it is important to consider that different cultures promote different behaviors and norms that influence perceptual processes. Deaf cultures emphasize a more holistic approach to visual perception because signing requires individuals to increase their visual perceptual spans in order to look a person in their eyes *and* perceive what they are signing below their face (Emmorey, Thompson, & Colvin, 2008). Deaf culture, therefore, perpetuates larger visual spans since people within this culture must know and use sign language. Deaf individuals, compared to people outside of the Deaf community, demonstrate enhanced peripheral detection and discrimination due to immersion in this culture. Aforementioned studies have shown this time and time again (Loke & Song, 1991; Neville & Lawson, 1987; Bosworth & Dobkins, 1999; 2002; Bosworth, Petrich, & Dobkins, 2013). Individuals who consider themselves to be part of a Deaf culture (both deaf and hearing) demonstrate enhanced abilities to detect motion in their peripheral visual fields (Loke & Song, 1991; Neville & Lawson, 1987; Bosworth & Dobkins, 2002). Additionally, Parasnis et al. (1996) showed it is not enough to simply have hearing loss, but an individual also must participate in cultural norms and customs of a Deaf culture (i.e. signing) in order to demonstrate differences in spatial perception. Microcultures such as Deaf culture therefore inform experiences that individuals undergo, and has the potential to alter one's perceptual abilities.

Second, cultures create different cognitions of the environment that shape how people perceive and interpret their worlds. The Carpentered Environment Hypothesis states that culture is created from aspects of the physical environment and individuals interpret stimuli in terms of what their culture dictates (Masuda, 2010; Henrich, Heine, & Norenzayan, 2010). If an individual is in an environment that stresses straight edges and right angles, he or she will be exposed to different structural criteria than someone from a tribal culture who views rounded huts and naturalistic settings daily. The Müller-Lyer Illusion, which features two identical length lines of which one only appears longer, has been shown to people across many different cultures (Henrich, Heine, & Norenzayan, 2010). People from tribal cultures were not fooled by this illusion, while Westerners were; it is possible that since Westerners view angles on a daily basis and subconsciously associate upward pointing angles with farther away objects and downward pointing angles with closer objects, then the arrows in the illusion affected them. Thus, physical environment affects visual perception.

Third, cultural values influence thinking style, which can influence aspects of the visual domain. Holistic thought processing is associated with a global perspective that takes context into consideration and focuses on relationships among objects contained within a scene (Nisbett & Miyamoto, 2005). Analytic thinking is denoted as localized cognition, where salient objects are attended to and background context is ignored. Typical culture research discusses differences in thinking styles for Eastern cultures that adopt a holistic approach versus Western cultures which emphasize an analytic perspective. Even within a Deaf culture, individuals born into the culture acquire skills and knowledges different from someone born into a Hearing culture. For example, children with Deaf parents are referred to as a Child of Deaf Adult (CODA) (Padden & Humphries, 2005). Similarly, there are other Deaf cultural subgroups such as Spouse of Deaf Adult (SODA) and Grandchild of Deaf Adult (GODA). These can be thought of a subcultures within a larger Deaf culture. All of these micro-subcultures follow a more holistic thinking style because Deaf culture in general adopts a larger perspective with greater emphasis on peripheral vision (Emmorey, Thompson, & Colvin, 2008).

Deaf and Video Game culture, while contained within a larger macroculture, have their own values, norms, and artifacts that can influence member's perceptual eperiences. Both Deaf and VGP show larger peripheral visual fields than their Hearing and NVGP counterparts (Buckley et al., 2010). Deaf people must pay attention to a larger visual field when signing and because they use sign language daily, they gain great amounts of experience attending to a large visual field (Pyers & Emmorey, 2008). Similarly, VGP must pay attention to increased visual fields while playing games to ensure their enemies do not sneak up on them.

Importantly, the more immersed into a microculture one is, the more experience the individual gains with cultural practices. For Deaf culture, the more absorbed one is with the culture, the more often and for longer durations that he or she will use sign language and gain more experience with increasing one's parafoveal awareness. In a similar vein, the more absorbed in the Video Game culture an individual is, the more instances at longer periods of time he or she will play video games. This is likely to affect his or her peripheral detection and discrimination. In all of the aforementioned studies, VGP and NVGP as well as Deaf and Hearing participants were all from Western cultures. The fact that there were significant differences between pairings demonstrates how these microcultures specifically affect peripheral visual perception and motion detection. It is possible, and even *expected*, that VGP and Deaf people will show more enhanced differences than NVGP and Hearing people as a function of cultural immersion. Using the subjective definition of culture, if people personally feel more attached and connected to a culture, they will participate in more customs more often, and thus gain more experience and exposure to these cultural climates.

Distinction between Culture and Experience

Bronfenbrenner (1979) describes human development in terms of relationships between multiple intrapersonal and interpersonal layers embedded within the environment. There are bidirectional relationships between an individual and his or her family, peers, school, media, and the macro-level culture (Bronfenbrenner, 1979). In order to understand which aspects of the different layers are most salient, one must understand cultural attributes of the *macrosystem.* Culture organizes structures in the environment in ways that predispose people to have certain experiences. For example, people belonging to a holistic culture will perceive objects as a whole, rather than parse apart a single image into smaller components (Masuda, 2010). Culture affects cognition, which in turn affects how people interpret objects in their environment. Based on what a culture dictates, interpreting certain stimuli as pleasing or beneficial will increase the frequency of exposure to that stimuli. If people are socialized to view something as beautiful, they will surround themselves with that ideal or gravitate toward environmental stimuli that perpetuate that attribute. Thus, culture informs experiences that shape psychological processes.

When a person gains more experience either in Deaf culture by learning more ASL or in Video Game culture by playing more video games for longer periods of time, he or she becomes more immersed in the culture itself. VGP who play video games for more than ten hours per week feel emotionally connected to the game community (Ortiz de Gortari, Aronsson, & Griffiths, 2011). These people have immense experience playing the game and are recognized members of the gaming community, but they feel attached to the culture created by the game and its players. They experience *Video Game Transfer*, where elements of the game permeate real life situations as a function of how immersed in the culture they have become due to playing the game so much (Ortiz de Gortari, Aronsson, & Griffiths, 2011). Similarly, a person who knows sign language for many years may subjectively feel more a part of a Deaf culture, compared to a person who has only just begun learning to sign. The experience a person gains by being a part of a certain culture will affect perception of objects. For instance, a person immersed in Deaf culture in the United States will use ASL almost daily. This increased experience using a signed language will affect the person's peripheral awareness, peripheral motion processing, and facial perception (Emmorey, Thompson, & Colvin, 2008; Neville & Lawson, 1987; Bosworth & Dobkins, 1999, 2002; Letourneau & Mitchell 2011, 2013)

Implications

The current review emphasizes the impact that microcultures have on individual's visual perception. It is possible that microcultures impact other facets of individual perception in audiological, emotional, and countless other cognitive domains. Future studies should assess how different microcultures affect different sociological and psychological principles. Based on the literature for Deaf and Video Game cultures, it appears that microcultures affect biological and physiological processes such as visual perception. If microcultures influence low-level perceptual processes, it is expected that they would have an impact on higher-level functioning as well.

The microcultures examined in the present paper are only two out of countless others. As Cohen (2009) argues, the aspiration in psychological culture research is to move away from grand rudimentary cultural categorizations and examine smaller distinct cultures. It is advised that there should be more research, both literature reviews such as this one as well as empirical studies conducted, that examine the effect of a multitude of microcultures on individual perceptual processes. For instance, does playing on a sports team or being involved in a sports culture affect visual perception? Gaining experience playing sports or watching sporting events will train the eye to focus on certain movements and visual properties so it is expected that a sports fanatic, someone who is heavily engrained into a sports microculture, will demonstrate differences in perceptual aspects.

Conclusion

It becomes pertinent that, after close examination of cultural research, more research is necessary to unlock the mysteries of how exactly different kinds of cultures affect visual perception as well as what aspects of those cultures are contributing to differences. It is possible that, because Deaf and Video Game culture rely on visual properties, they impact visual perception. Perhaps a culture that places heavy emphasis on visual aspects affects the way an individual perceives other visual attributes. The importance of these microcultures in other facets -- audiological, attention, memory, emotion -- has yet to be explored.

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APPENDIX A

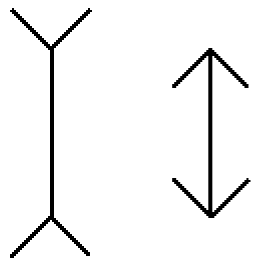

Figure 1. Müller-Lyer Illusion. Participants from non-Western cultures do not perceive the lines as different lengths.

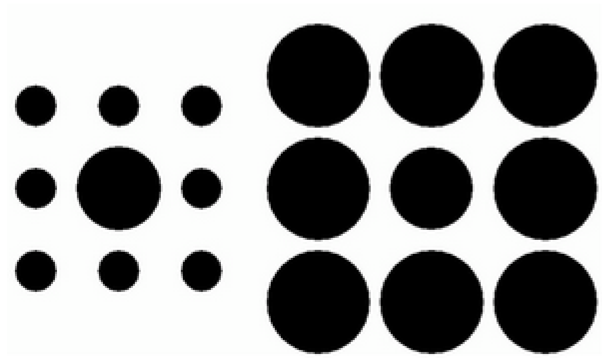

Figure 2. Ebbinghaus Illusion. Differences were observed in perception of this illusion between Deaf and Hearing participants with schizophrenia.

APPENDIX B

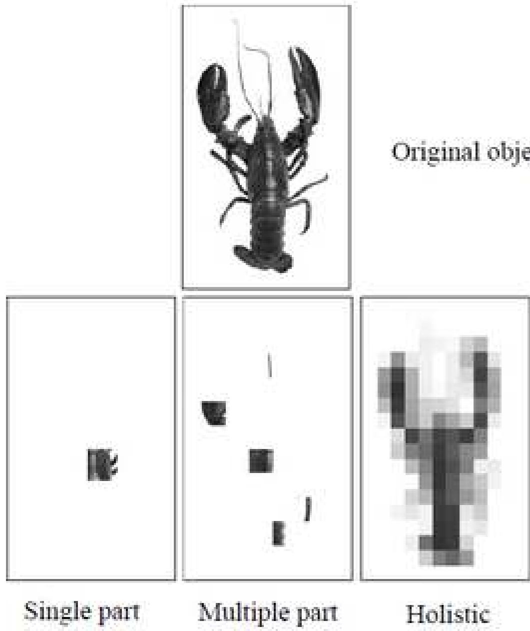

Figure 3. Example stimulus, taken from Ishii, Tsukasaki, and Kitayama (2009). The original object was masked either analytically (showing only a single or multiple parts) or holistically (showing the entire blurred image).

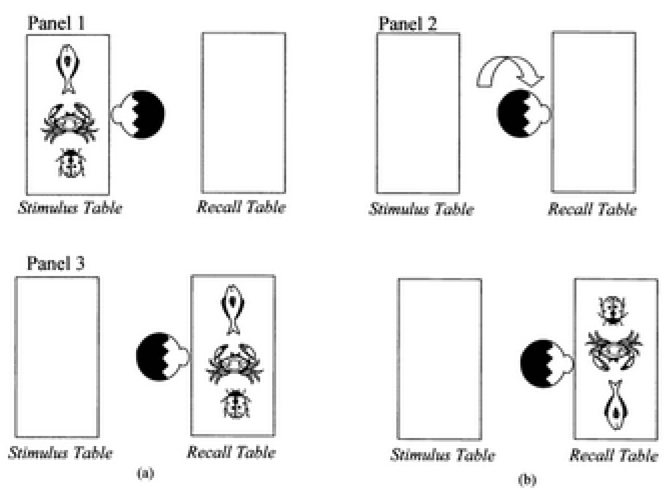

Figure 4. Animals in a Row Task, taken from Li and Gleitman (2002). Panel 3a shows the response of a person from an allocentric culture. Panel 3b shows the response of a person from an egocentric culture.

APPENDIX C

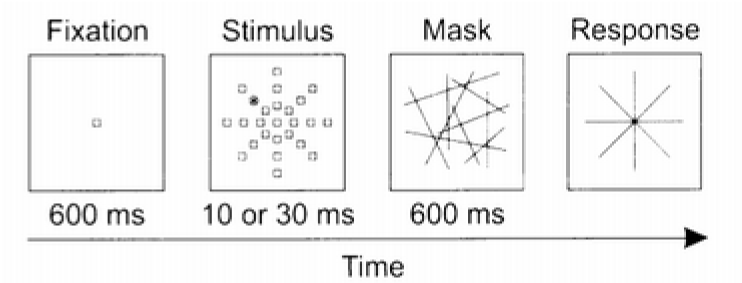

Figure 5. Uniform Field of View Task, taken from Feng, Spence, and Pratt (2007). Participants were instructed to recognize a target and remember its location after a masking stimulus is shown.