Use only English to answer the following questions. Your answers will be graded on the clarity of the exposition, as well as on the appropriateness, correctness and relevance of the particular examples and facts that you use to illustrate or to support your points.

I. Below is the full transcript of a podcast selected from Scientific American. This podcast involves a narrator and verbal recordings of a professional (enclosed by quotes). Please read through the transcript carefully and **summarize with your own words. Limit your answers to 300 words (25%).**

BRAIN SIDES ARE BOTH BUSY IN NEW LANGUAGE LEARNING

Anyone who has tried to learn a new language as an adult knows how hard it can be. And usually the ability to comprehend someone else comes before the capacity for speaking the new tongue.

"When you're listening, you can kind of gloss over the details. So, you may not need to understand every single syllable, every single word perfectly."

Cognitive neuroscientist Kshipra Gurunandan, of the Basque Center on Cognition, Brain and Language. But actually speaking a new language fluently takes much more work.

"Adults are not quite able to reproduce or really hear foreign sounds."

Gurunandan suspected that, as we learn, the relative ease of comprehension might be explained by changes in the area of the brain that processes language. It's been known since the 1800s that, for most people, the left hemisphere of the brain is essential for language.

"However, in more recent times, we've started to realize that it's not quite that simple."

For example, when people suffer brain injuries to the left hemisphere, the right hemisphere can take over language tasks. That flexibility suggests that language is not the exclusive domain of the left hemisphere.

To find out if the two sides of the brain process comprehension and speech differently during language learning, Gurunandan and her team scanned the brains of Spanish-speaking volunteers who were learning either Basque or English.

"They performed language tasks in the scanner involving reading, listening, and speaking in their native and their new language. And then we looked at whether activation in the language regions was greater in the left hemisphere or the right hemisphere for each of the languages in each task."

The researchers found that speaking primarily activated language regions in the left side of the brain no matter how advanced the language learner was. But reading and listening comprehension were much more variable.

"In the earliest stages of language learning the native and new languages tended to activate the same hemisphere, while in the more advanced learners they activated different hemispheres. And the switch from the same to the opposite hemispheres was largest in reading, it was slightly smaller in listening and it was non-existent in speaking."

The researchers reason that speech may be more constrained to the left hemisphere because it contains specialized circuits dedicated to the motor control of speech production.

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"While in comprehension, you have the auditory system and the visual system, which are more bilateral—and it's possible that is why comprehension is more bilateral in the brain."

The study is in the Journal of Neuroscience. [Kshipra Gurunandan, et al. (2020). Converging evidence for differential specialisation and plasticity of language systems]

Learning a new language will always be challenging, but Gurunandan says you shouldn't let that stop you.

"Language learning is a hard skill. It's hard for everybody. But it's not because of your brain plasticity. You can learn words, you can learn grammar rules, your language learning capacity is just fine."

As long as you maintain your *joie de vivre*.

Scientific American
60 Second Science
December 16, 2020

II. Read the following excerpt from Hall et al. (2018) and answer the questions below.

Language deprivation occurs due to a chronic lack of full access to a natural language during the critical period of language acquisition (when there is an elevated neurological sensitivity for language development), approximately the first five years of a child's life (Mayberry & Lock, 2003; Newport, 1990). Language deprivation during the critical period appears to have permanent consequences for long-term neurological development (Leybaert & D'Hondt, 2003). Neurological development can be altered to the extent that a deaf child "may be unable to develop language skills sufficient to support fluent communication or serve as a basis for further learning" (Lederberg et al., 2013).

Exposure to a fully accessible language has an independent influence on brain development separate from only the auditory experience of hearing loss. Indeed, recent neuroimaging studies indicate thé presence of adult neurostructural differences in deaf people based on timing and quality of language access in early childhood (Mayberry et al., 2011; Penicaud et al., 2013; Skotara et al., 2012).

Hall et al. (2018). Language Deprivation Syndrome: A Possible Neurodevelopmental Disorder with Sociocultural Origins

Questions:

1. **Based on this excerpt, who are most likely to suffer from language deprivation? Be as explicit and comprehensive as possible. (5%)**
2. **How will language deprivation affect a child's development, in terms of their language abilities and other (socio-)cognitive acquisition? Give examples to support your arguments. (10%)**
3. **How can we, as caregivers and/or instructors, prevent language deprivation? (10%)**

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III. Please read the following passage and answer the question below.

WHEN OUR GAZE IS A PHYSICAL FORCE

Have you ever sensed that someone might be watching you? You get a prickly feeling at the back of your neck and turn to see a stranger staring at you across the room. It sometimes seems that we can feel a person's gaze as a physical sensation. And, from a single glance, we can tell a lot about a person, such as their moods, intentions and focus. Is their gaze dangerous, interesting or attractive? Do they stare directly or glance to the side? If "eyes are the window into the soul," then a glance reveals far more than we know.

Recent studies demonstrate that humans attribute gaze with physical properties. We create tacit mental schemes in which the visual attention of others is computed as a forceful beam emitted from the viewer's eye and directed at the object of interest. These mental schemes allow us to take cognitive shortcuts to process peoples' visual attention quickly and efficiently.

Gaze is an elemental form of communication that can coordinate activities and convey social dynamics without a gesture or spoken word. It requires a rapid interpretation of the meaning behind another's gaze, but the trade-off for the speed of that interpretation is the mistaken understanding of gaze as something that can move things in our environment. These studies show that this interpretation is subconscious and automatic, and that it occurs even in those who would consciously deny that vision exerts any force.

You might expect that such an erroneous interpretation would be detrimental. In fact, while there seem to be few if any adverse consequences these findings may underlie rich and diverse cultural references to the outward force and power of the gaze. The results of the experiment demonstrate an ancient human idea linking gaze with physical properties. This notion, as old as the Greeks, is known as the "extramission" theory of vision. Extramission literally means "sending out," and the extramission theory is the belief that vision is a force emitted from the eye. It is an intuitive understanding of vision common among children that persists among many adults. In contrast, the modern visual theory is called "intromission," and is based on the notion that vision results from light entering the eyes.

Using a series of ingeniously simple experiments in one study, researchers found that subjects associate gaze with a physical force. Subjects viewed a computer display that had an image of a tube, roughly the size of the end of the paper towel roll, standing vertically on a table. At one end of the table was an image of a face gazing at the tube (researchers dubbed the face avatar Kevin). Subjects were instructed to tilt the tube towards Kevin's image using specific keys on a keyboard until they felt the tube had reached the critical angle at which it would tip over. The critical angle reported by subjects depended upon whether Kevin was blindfolded. If Kevin was perceived as gazing at the tube, the critical angle was greater than when Kevin was blindfolded, suggesting that his gaze was impressing some force upon the tube that needed to be overcome for the tube to fall.

Likewise, in a second experiment, subjects were presented with the image of Kevin either gazing at the tube or gazing away in the opposite direction and asked to report the critical angle of the tube before toppling. Once again, the angle

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depended on Kevin's perceived gaze and was much greater when Kevin gazed straight at the tube compared to when Kevin was turned away. Finally, in a third experiment subjects were told that Kevin was either looking directly at the tube or focused beyond the tube at a wall at the other end of the table. Once again, the critical tilt angle was greater if subjects thought Kevin was gazing at the tube rather than the wall.

Participants in this study were screened for belief in extramission beforehand and those who expressed such a belief were excluded. So, it is remarkable that all remaining participants intuited a force based upon gaze, even while they disavowed any belief in such a force emanating from the eye. What has emerged in this study is an implicit, unrecognized cognitive shortcut employed by humans to rapidly process gaze, but which leads us to comprehend it as something that affects objects in the world.

To test this theory, researchers employed brain imaging methods to demonstrate that gaze perception activates brain regions associated with motion. In this case, subjects were presented images of moving dots or an image of a face gazing at a tree. Brain activity was measured using functional magnetic resonance imaging (fMRI), which detects brain activity by measuring local brain oxygen consumption. Areas of the brain involved in processing visual motion (the right middle temporal cortical areas) and in understanding the thoughts and intentions of others (the right temporal parietal junction) were involved in processing the face's gaze when staring at the tree. However, just as with the blindfolded Kevin, these fMRI signals halted when the face in these studies was blindfolded. Here, the brain processes the gaze as movement even when no movement occurs, again showing an extraordinary misapprehension of reality.

Belief in the power of gaze appears in stories and myths throughout the centuries. Medusa turned people to stone with her gaze. The catoblepas and, more famously, the basilisk, both described by Pliny the Elder, could kill with the single glance. In Shakespeare's Venus and Adonis, Venus complains of the pain caused by Adonis' glance: "Thine eye darts forth the fire that burneth me." While in John Donne's The Ecstasy, the glances of the lovers intertwine and bind them as if they were their clasped hands. And, of course, no list of cultural references to gaze would be complete without mention of the Jedi master or Superman.

Gaze is a powerful element of social interaction. It reveals where a person is focusing their attention, and, when directed at us, it can have a strong emotional effect. Gaze can play a role in social organization, with a direct gaze demonstrating social dominance and gaze aversion indicating passivity. Eye contact can elicit alertness and bodily awareness, while indifference or aversion to eye contact can signal emotional or neurological disorders. When we direct our gaze at something or someone, others who notice subconsciously direct their gaze in the same manner. We can take advantage of this tendency to deliberately influence the gaze of others. Magicians take advantage of the ability to redirect gaze and attention to enhance their sleight of hand. Visual artists can manipulate attributes of a work of art such as luminosity in order to direct visual gaze to specific features of a painting. In dance, gaze can be used to convey the power dynamics between the characters on stage, while musicians rely upon gaze as an essential means of communication, using it to help in cuing and synchronization during the performances of orchestras and choirs.

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Gaze is a means of communication that impacts us in many ways, subconsciously and quickly, so quickly and energetically that one investigator described the effects of gaze as "exuberant." And while magicians may know how to manipulate gaze to enhance their illusions, the illusion of gaze as a physical force is magic enough.

Question: What are the various types of evidence provided in the article showing that we believe gaze has power? (15%)

IV. Please read the following passage and answer the question below.

DOG DOMESTICATION MAY HAVE BEGUN BECAUSE PALEO HUMANS COULDN'T STOMACH THE ORIGINAL PALEO DIET

It's easy to understand why early humans domesticated dogs as their new best friends. Tame canines can guard against predators and interlopers, carry supplies, pull sleds and provide warmth during cold nights. But those benefits only come following domestication. Despite more than a century of study, scientists have struggled to understand what triggered the domestication process in the first place. A new theory described today in Scientific Reports posits that hunter-gatherers whose omnivorous digestive system prevented too much protein consumption likely shared surplus meat with wolves. Those scraps may have initiated a step toward domestication.

"This is the first time that we have an ecological explanation for dog domestication," says lead author Maria Lahtinen, a senior researcher at the Finnish Food Authority and a visiting scholar at the Finnish Museum of Natural History. "I personally don't think that there is a simple, easy answer behind dog domestication, but we need to see the full picture and complexity of the process."

Lahtinen did not originally set out to solve a long-standing dog mystery. Instead she was studying the diet of late Pleistocene hunter-gatherers in Arctic and sub-Arctic Eurasia. At that time, around 20,000 to 15,000 years ago, the world was engulfed in the coldest period of the last ice age. In frigid environments then, as today, humans tended to derive the majority of their food from animals. Nutritional deficiencies came from the absence of fat and carbohydrates, not necessarily protein. Indeed, if humans eat too much meat, diarrhea usually ensues. And within weeks, they can develop protein poisoning and even die. "Because we humans are not fully adapted to a carnivorous diet, we simply cannot digest protein very well," Lahtinen says. "It can be very fatal in a very short period of time."

During the coldest years of the last ice age—and especially in harsh Arctic and sub-Arctic winters—reindeer, wild horses and other human prey animals would have been eking out an existence, nearly devoid of fat and composed mostly of lean muscle. Using previously published early fossil records, Lahtinen and her colleagues calculated that the game captured by people in the Arctic and sub-Arctic during this time would have provided much more protein than they could have safely consumed.

In more ecologically favorable conditions, wolves and humans would have been competing for the same prey animals. But under the harsh circumstances of the Arctic and sub-Arctic ice age winter, sharing excess meat with canines would have cost people nothing. The descendants of wolves that took advantage of such handouts would have become more docile toward their bipedal benefactors over time, and they likely went on to become the first domesticated dogs. As the authors point out, the theory makes sense not just ecologically but also geographically: the earliest Paleolithic dog discoveries primarily come from areas that were very cold at the time.

The new study presents a "fascinating idea about lean protein being a food that humans would have discarded but wolves may have relied on during winter months in the Arctic," says Brian Hare, an evolutionary anthropologist at Duke University, who was not involved in the work. "I think it offers another vital clue for how the human-dog partnership might have been initially fueled."

Questions:

1. **According to the article, what was the weather like when dogs were first domesticated? What evidence supports the argument? (15%)**
2. **Please write a 120-word summary of the article. Be sure to include all the important information. (20%)**