# Investigating the Influence of Familiarity in a Three-Dimensional Soundscape of Multisensory Factors Shaping Fetal Perception

Shafiq Ur Rehman[1], Muhammad Aoun[2*], Asia Shabeer[3], Syed Junaid Iqbal[4], Amar Aftab[5]
[1]Department of Computing & Information Technology, Mir Chakar Khan Rind University of Technology, Dera Ghazi Khan
[1]Department of Computer Science, Lasbela University of Agriculture, Water, and Marine Sciences, Baluchistan 90150, Pakistan
[2]Deparmnet of Computer Science and Information Technology Ghazi University Dera Ghazi Khan, Punjab, Pakistan.
[3]Department of Computing Science and Information Technology Institute of Southern Punjab, Multan.
[4]Department of Electrical Power Engineering (National University of Sciences and Technology
[5]Department of Information Technology, the Islamia University of Bahawalpur
* **Correspondence**: muhammadaoun151@gmail.com

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The ability of human fetuses to recognize their mother's voice was studied in this research. Sixty full-term fetuses were randomly divided into two groups: those who were read a taped recording by their mothers or those who were read the same recording by a female stranger. Unfortunately, our in-depth acoustic research showed no discernible difference beyond a fleeting shadow in the here and now. To explore the duration spent moving across all intervals, the frequency of movements in each temporal realm, and the epoch at which the very first movement occurred, we employed the powerful tool of repeated measures analysis of variance (ANOVA) in the name of scientific research. A peaceful calm pervaded the delicate balance of information, creating an air of mystery. Experience has shown to influence fetal sound processing since different behaviors have been discovered in reaction to familiar and unfamiliar sounds. It lends credence to the idea that there is some interplay between the genetic expression of brain development and the experience of a given species, which is central to the epigenetic model of speech perception. The speaker is roughly 10 centimeters above the mother's belly, and the average sound pressure level (SPL) is 95 dB. No stimulation, no sound (from mother or stranger), and no stimulation lasts two minutes. The fetal heart rate increases for 4 minutes when the mother's voice is present, while the fetal heart rate lowers for 4 minutes when an unfamiliar voice is present. Our investigations, however, went far beyond the domain of pulsations and reverberations. We looked at the period beginning five seconds before the onset of sound and continuing for another five seconds to reevaluate the complex dance of fetal movement.

**Keywords:** Spatial Influences, Fetal familiarity, Voice recognition, Sound stimulation, Stranger's voice.

**Introduction:**

Although the development of auditory sensitivity and evidence for the Gestational Age (GA) of onset is clear in full-term human fetuses, these details remain murky in preterm fetuses. Understanding the era when practical development may be influenced by environmental sensuous stimulation could be much improved with such data. Furthermore, a normative repository is crucial for identifying healthiness status (i.e., abnormal development) in high-risk fetuses and examining brain development mechanism-related difficulties. Researchers have been monitoring fetal development since the late 1800s [1]. It was in the early 1980s that systematic, ongoing investigations into fetal physical observation methods and the development of advanced ultrasonography and off-the-shelf availability got underway. It is well known that the fetus begins responding to auditory stimuli at around 30 weeks of GA (Gestational Age). They consistently exhibit high-pass filtered white noise of 2–3 seconds, eliciting cardiac and body motion responses to 110 dB SPL (estimating uterine attenuation from 0–approximately 35 dB) [2]. Threshold, amplitude, frequency, and stimulation intensity [3] were fine-tuned over a semester (from 37 to 42 weeks of GA).

New insights into human life before birth keep emerging as scientists explore the complex world of fetal development. The developing fetus's ability to recognize and respond to external stimuli is one of the many fascinating features of this journey before birth. In particular, the authors hope to learn more about how fetal familiarity with mother voices affects the fetal aural environment and the spatial features of fetal voice recognition. It goes beyond the commonplace emphasis on pulsations and reverberations to explore the world of prenatal perception. Our research travels back to the mysterious world of fetal movements in three-dimensional space, beginning five seconds before sound onset and continuing for another five seconds.

The fetal brain also can recognize and understand segmented speech. For instance, the fetal reaction to heartbeat is said to have slowed down between weeks 36 and 40 of GA, with the fetus now reacting to speech stimuli between 83- and 95-dB SPL (/i/ and /â/). More recently, fetuses can tell the difference between male and female voices and between the pairs of consonant vowels / babi / and / Biba / [4].

It has been observed [5] that preterm fetuses (GA 26 to 34 weeks) can discriminate vowels (/ ee / and / ah /), albeit at a higher stimulus intensity of 100 to 110 dB. The best explanation for the fetus's consistent, largely unmodified, regular breathing is that it can distinguish between sounds, as suggested by these considerations. A mother's or unfamiliar voice coming through the speaker will calm either mood.

The fact that a fetus can recognize its mother's voice proves the strong bond between mother and kid. The ability to recognize the mother's speech as distinct from other voices is a well-documented feature of prenatal cognition. However, geographical elements' role in this recognition must still be better understood. We hope to shed light on a previously undiscovered aspect of fetal development by investigating how the fetus's position within the womb and the spatial relationship between the speaker and the fetal head affect the recognition of familiar voices.

Essentially, it does not report a distinguishable response to the voices of the stranger and the mother, while the response does vary based on whether the mother is speaking or playing a tape. DeCasper [6] observed that an embryo can distinguish between familiar rhyme tapes and tapes with unfamiliar rhymes the mother has read. There are 33–37 weeks in a standard GA. However, the hatchling doesn't respond to novel rhythms, which seems to disprove the findings of the above discoveries, which invariably respond to conversation. The question of whether a baby can remember and recognize its mother's voice and distinguish between familiar and unfamiliar sounds is yet unanswered by these results.

According to specific recent theories, the fetus may be able to recognize and remember the human voice. Researchers employed non-nutritive sucking standards to demonstrate how infants prefer the sound of their mothers' voices to that of strangers' voices and how babies learn to distinguish between their mother's language and other languages more effectively when exposed to the mother's language during the last six weeks of pregnancy [7]. These preferences emerge quickly after birth, lending credence to the idea that a fetus may remember and recognize the human voices to which it is exposed in utero (intrauterine discourse involvement speculation). Support for this idea will affect the early development of social and cognitive capacities (including acquiring and connecting a second language).

Our study uses cutting-edge acoustic techniques to explore the complex realm of fetal auditory perception. This research aims to further our knowledge of fetal cognition by determining whether or not different spatial characteristics affect the fetal reaction to familiar sounds. Furthermore, we will look into how the spatial placement of sound generators inside the uterus affects fetal activity. Our goal in using the robust technique of repeated measures analysis of variance (ANOVA) is to determine if even slight variations in spatial arrangements have a sizable impact on the fetus's sensory experience. Our study prepares the groundwork for answering these critical questions about the spatial subtleties of fetal speech detection. We seek to shed light on the wonder surrounding us when we consider the tranquility of the maternal womb and the delicate ballet of fetal movements. This study adds to our knowledge of prenatal cognition. It furthers our exploration of the extraordinary world of the growing fetus by studying the complex relationship between familiarity and spatial layout.

**Objective:**

This research aims to learn if and how a human fetus responds to the sound of its mother's voice. The study's overarching goal is to learn how a fetus's genetic makeup interacts with its environment during its formative stages to shape how it reacts to familiar and novel noises. The study also aims to determine how fetal heart rate and movement are affected by being exposed to acoustic stimulation, particularly the mother's voice. This study's overarching goal is to learn how far along in the gestational period a human fetus is in its receptivity and interaction with auditory stimuli by examining the complex link between the fetus and its mother's voice. Examining the complex interplay between genetics and the prenatal environment, its primary goal is determining if and how a fetus responds to the comforting sound of its mother's voice. Through examining this confluence, the research hopes to shed light on the processes by which a developing embryo detects and interprets both familiar and unknown noises, with the ultimate goal of revealing the characteristics of this sensory interplay while still inside the mother's womb. In addition, the study aims to determine how critical physiological markers like fetal heart rate and movement are affected by acoustic stimulation, specifically the mother's voice. This aspect seeks to reveal how much prenatal exposure to sound affects the growing fetus's physiological reactions, which could provide insight into how early sensory experiences shape prenatal development.

This study sets out to answer several questions about prenatal sensory experiences, including how the fetus reacts to the sound of the mother's voice and how genes and the environment interact. By delving into the ways these experiences are expressed in physiological changes like changes in heart rate and movement, this study hopes to shed light on the complex process of fetal development and the role of sensory input, especially the mother's voice, in molding the early years of a person's existence.

**Contribution:**

**Fetal Voice Recognition:**

The study adds to our knowledge of fetal voice recognition and the impact of maternal speech on the developing baby's heart rate. This study investigates whether fetuses can recognize familiar sounds by contrasting their reactions to their mother's voice and those of a female stranger's voice.

**Prenatal Experience and Sound Processing:**

The significance of prenatal experience on fetal sound processing is highlighted in the study. There is a correlation between the fetus' genetic makeup and its prenatal experiences, as shown by the fact that the fetus exhibits diverse behaviors in reaction to familiar and unexpected sounds.

**Methodological Advancement:**

The study uses a thorough technique, including repeated measures analysis of variance (ANOVA), to investigate fetal mobility across various time points. This methodological strategy adds to the existing scientific research instruments for investigating fetal reactions and allows for a more in-depth evaluation.

**Implications for the Epigenetic Model:**

Implications for the Epigenetic Model The results support the idea that prenatal experience interacts with genetic expression during brain development. This idea is foundational to the epigenetic model of speech perception. It has wider implications for our understanding of environmental factors' role in shaping a developing brain's capacity for complex thought.

This text provides an answer to such a question. In particular, we used FHR and body movement estimate clues to determine the chick's ability to distinguish between its mother's voice and an unfamiliar youngster's. The unique features of sound take time to observe, so monitoring the developing embryo for a more extended period is essential. To track fetal development and heart rate in 2 minutes, we used a novel article studied by a well-known or recently-matured woman. Using brief clamor notices, the jolt's concentration (95 dB SPL) is less than the ponders, allowing it to attract fetal attention without inducing fear.

Each mother's voice on the recordings is that of her unique embryo, while the other hatchling may have a more alien-sounding voice. This identifier ensures that the acoustic features of a specific mother's voice do not account for individual differences in response to familiar and unfamiliar noises.

**Material and Methods:**

**Participants:**

Sixty full-term fetuses (M = 38.4 weeks GA, SD = 1.1) were tested from mothers who had visited a hospital in southern China for prenatal treatment. The risk of complications for these singleton pregnancies is minimal. One experiment was conducted in a lab near the fetal evaluation room for outpatients. At this moment, a gender identity has not been established by testing. The study includes a summary of the research subjects. Sixty fetuses at full term were included in the study, with a mean GA of about 38.4 weeks and a standard deviation of 1.1 weeks. These embryos were chosen from moms receiving prenatal care in southern China. Interestingly, the research highlights the low incidence of problems in these pregnancies, suggesting that the fetuses analyzed resulted from singleton pregnancies. According to the report, the experiment was conducted in a laboratory near the outpatient fetal evaluation room. This location was chosen so expecting moms could get to the hospital quickly and easily. The fetuses' gender identities were unknown at the time of the study, highlighting the emphasis on prenatal development and the lack of elements associated with gender identity in the study's environment. This background on the study's subjects is necessary for comprehending the research's cohort and emphasizes the controlled nature of the study, given the rarity of problems in singleton pregnancies.

**Equipment:** Mother's voice reading an adult provided the 2-minute speech stimulationwas examined using a Sanyo tape recorder (M-1770K). The XingQui-ND2 SPL meter is a tool for

gauging the volume of an audible signal. Using a Sonicaid RS232 Cardiograph (Oxford Instruments), we recorded FHR continuously on a strip of paper in terms of beats per minute (bpm). If you have a Macintosh computer and a digitizer, you can quickly obtain FHR (for further information, see Coleman, Kisilevsky, and Muir, 1993). A Toshiba CAPASEE (SSA-220A) real-time ultrasound scanner was used to see human movement, and a Sharp VCRA58 Multi-Lingual OSD VHS recorder was used to capture footage live over the internet.
This study's "Equipment" section details the many instruments and gadgets employed during data collection and analysis. During the experiment, the fetuses were exposed to a recording of the mother's voice reading poetry written for adults. A Sanyo tape recorder (M-1770K) was used to play back the speech recording, showing that the audio quality and playback equipment were carefully considered to provide consistent and clear auditory stimulation.

The study used several instruments, not just audio recording gear, to acquire its findings. The XingQui-ND2 SPL meter was used to measure the sound pressure level, which is essential for keeping the experiment's conditions stable. Fetal heart rate (FHR) was continuously recorded using a Sonicaid RS232 Cardiograph (Oxford Instruments), highlighting the significance of accurate monitoring throughout the investigation. The thorough approach to data gathering is further emphasized by including details such as using a Macintosh computer and digitizer to obtain FHR. During the investigation, a Toshiba CAPASEE (SSA-220A) ultrasound scanner was used to visualize human movement, particularly fetal movements, in real-time. Using an internet-connected VHS recorder that supports many languages, such as the Sharp VCRA58 Multi-Lingual OSD, further exemplifies the all-encompassing character of the data collected. The researchers' dedication to using cutting-edge technology is evident in their decision to purchase high-quality data collection and documentation instruments.

**Procedure:**

The woman was only partially reclined on the bed for the 6-minute procedure. Every developing human being is randomly assigned to one of two possible sound states, each consisting of three 2-minute cycles: silence, vocalization (by mother or female stranger), and silence. Each group of embryos sang a different tune. Each batch has thirty newborns. The term "voice" refers to a recording of a mother's voice for the mother voice group. In the stranger's voice condition, the critical participant used the female inquiry about the group member's voice. Still, we listened to a recording of the previous embryo from the acing group for the rest. The inciting sound is typically broadcasted at 95 dB SPL from a speaker roughly 10 cm above the mother's midsection. Keep track of the fetal body's motions and heart rate constantly.

**Result and Discussion:**

**Body Movement:**

To re-evaluate the analysis of body movements in earlier research using short-term stimuli, we compared the existence of body movements 5 s before the commencement of the sound to those within 5 s after the sound began. There is no distinction between the two periods on short-term measurements. This study's prolonged stimulation allows for many additional tools over the long haul. Table 1 displays the average and standard deviation of results for body motion. Repeated measures analysis of variance (ANOVA) was used to examine the overall time spent moving across all three intervals, the number of movements in each interval, and the time it took for the first movement to occur across all three intervals. There was no discernible effect.

This study's "Body Movement" portion is to reevaluate and broaden the examination of fetal body movements, focusing on those movements' effects on responsiveness to auditory stimuli. This study compares bodily movements that occur during a 5-second timeframe before and after the arrival of sound. Short-term indicators show no significant difference between the two time periods, which is the study's principal finding.

The focus on sustained stimulation is what makes this research stand out. By allowing for more extended periods of stimulation, more options for analysis and understanding are made available. Table 1 displays the average and standard deviation of body motion data and is included in the study's results section to emphasize the thoroughness of the investigation into fetal body motions in response to auditory stimulation.

In addition, the study uses a robust statistical method known as repeated measures analysis of variance (ANOVA) to go even further into the numbers. This method helps calculate how long it takes to move across several time intervals, how many times you move throughout each interval, and how long it takes for your first movement to occur. The most crucial point from this section is that no significant change in fetal body movements is seen despite the prolonged stimulation duration and thorough analysis. This finding provides essential evidence of the potential impact of the studied auditory stimuli on fetal mobility.

**FHR:**

Figure 1 depicts all of the collected FHR readings every 6 minutes. We analyzed heart rate acceleration in the first 10 seconds after introducing stimuli to replicate earlier work using short-term stimuli, but we did not find any significant impacts. We examine the long-term effects of speech on FHR by separating them into three distinct 90-second intervals: (a) 90 seconds before the commencement of speech, (b) 90 seconds during speaking, and (c) 90 seconds after the speech shift. Since the stimulus's on-and-off times are fixed, we focus on these intervals rather than the full 6 minutes.

As a result, the information is shown in a dual-stream format, first showing the speech offset and then each item's speech concurrently. Using an ANOVA with 1 (condition: mother and stranger; between subjects) _1 (time: 1-90 s; within the subject), we discovered that there was no time Significant change, F (89, 5162) 0.319, p .05, or condition F (89, 5162) _0.882, p .05, in the FHR data collected 90 seconds before the commencement of the sound. However, data analysis within the first 90 seconds after the speech began revealed a significant voice interaction (F (89, 5162) _.31, p_.05) between the mother and the stranger's conditions. Analysis of post-stimulus data, which only reveals the significant effect of speech, confirms that the difference observed in Figure 1 persists until the end of the recording time. The average FHR of the fetus hearing the mother's voice was consistently higher than the baseline. Still, the FHR of the unfamiliar fetus was consistently lower (F(1,58)_ 4.635, P.05. After the stimulus began, the average difference in FHR between the mother speech group and the stranger speech group widened from 2.25 bpm to 8.02 bpm. In contrast, it had been 3.06 bpm to 3.16 bpm before the stimulus began.

**Table 1.** Mean body moment score in the two conditions

| Measure | Condition | |
|---|---|---|
| | **Mother's voice** | **Stranger's voice** |
| **Duration of moment** | | |
| Pre-stimulus | 7.033 (11.01) | 12.19 (21.71) |
| Stimulus | 12.48 (16.13) | 9.53 (13.13) |
| Post-stimulus | 12.23 (16.66) | 9.77 (13.04) |
| **Number of moments** | | |
| Pre-stimulus | 2.17 (2.1) | 1.03 (1.5) |
| Stimulus | 2.98 (2.6) | 1.38 (1.6) |
| Post-stimulus | 2.23 (1.9) | 1.22 (1.7) |
| **Latency to the first moment** | | |
| Pre-stimulus | | |

| | | |
|---|---|---|
| Stimulus | 29.96 (27.24) | 42.34 (48.1) |
| Post-stimulus | 28.01 (28.83) | 48.54 (49.8) |

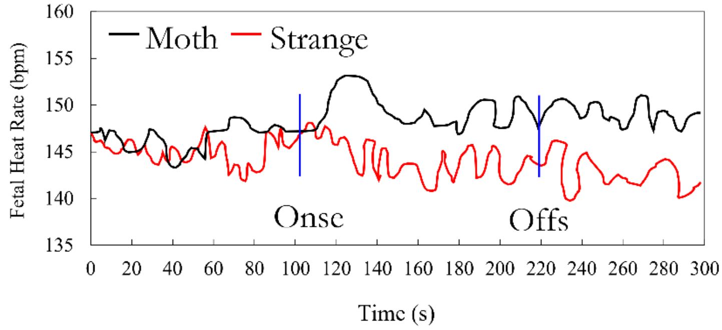


**Figure 1:** Average fetal heart rate for the 2 min before voice onset, 2 min mother's or stranger's voice, and 2 min following voice offset

We also looked at the fetus's maximum and minimum heart rates before and after stimulation to verify the reliability of the findings. Twenty-one out of thirty fetuses stimulated in a maternal environment reached a higher peak than the control group. This value is significantly above the chance expectation of 2 (1, N 30) 4.80, p.05. Also, like the control group, 21 out of 30 fetuses in the unfamiliar state showed a lower minimum value during the stimulation (i.e., 2 (1, N 30) 4.80, p). The findings of this study lend credence to the idea that prenatal exposure to language occurs throughout gestation. When a fetus hears its mother's voice through a speaker, its heart rate typically increases by five bpm within the first 20 seconds after the sound begins and maintains that level for the duration of the recording. The fetal heart rate decreases by four beats per minute (bpm) when exposed to the female stranger's voice presented in the same way. At 26 seconds after the stimulus began, post hoc analysis revealed a statistically significant difference in FHR between the two groups. Since this is not a universal response to noise, it rules out the possibility that hearing the sound was responsible for the finding.

The acoustic qualities of the channel are not to blame here, either, as the same channel is used for both sets of unborn children. Different fetuses have different voices, yet each woman's voice is heard twice. The unborn babies in both groups hear the same sounds, but one group hears its mother's voice while the other hears an unfamiliar voice. That the fetus reacts differently to its mother's voice than to the voice of a stranger suggests that it is capable of remembering and recognizing the unique qualities of that voice.

We discovered no difference in how the subject moved when exposed to either the mother's or the stranger's speech, but there was a significant difference in how their heart rate responded. Even when merely using measures of body movements as a response, [8] found that a fetus's behavior did not change in response to hearing either the mother's familiar voice or the voices of unfamiliar people. These contrasting results show that various approaches are required to understand the fetal sensory system fully.

Our findings also differ from those from studies that employed vibratory acoustic stimuli or short-term bursts of noise at 105 or 110 dB [9]. According to research on human fetal and neonatal behavior, within 20 s of r behavior (for example, heart rate changes), the fetus exhibits immediate short-term physical activity and heart rate [10][11]. Discrimination against habituation increased intensity shifts in stimulation [12].

Preferences for the maturation of the brain in the fetus [13]. He hypothesized that they are forebrain-independent reflexes originating in the brainstem. Reflexes and discrimination that occur within a few seconds of stimulus are known to be mediated by the brainstem, and it is widely believed that these responses are also rigid. This study looked at fetal voice recognition rather than fetal speech discrimination, which contradicts earlier research on fetal perception. According to Joseph's observations, it is not known whether the brainstem or higher-order structures are responsible for mediating the speech recognition response we have confirmed in this investigation.

Our findings provide credence to a theoretical model of speech perception that heavily emphasizes the prenatal environment in laying the groundwork for later language development. In particular, the findings are well-suited to epigenetic models in light of recent advances in mammalian brain development [14]. In [2], we postulate that a species' unique experience interacts with the genetic expression of brain development. Werker and Tees hypothesize that shifts in the "expected experience" account for infants' observable biases towards certain types of speech. The change from "independent to experience" (i.e., gene expression) to expected experience would have to occur before birth if this were the case.

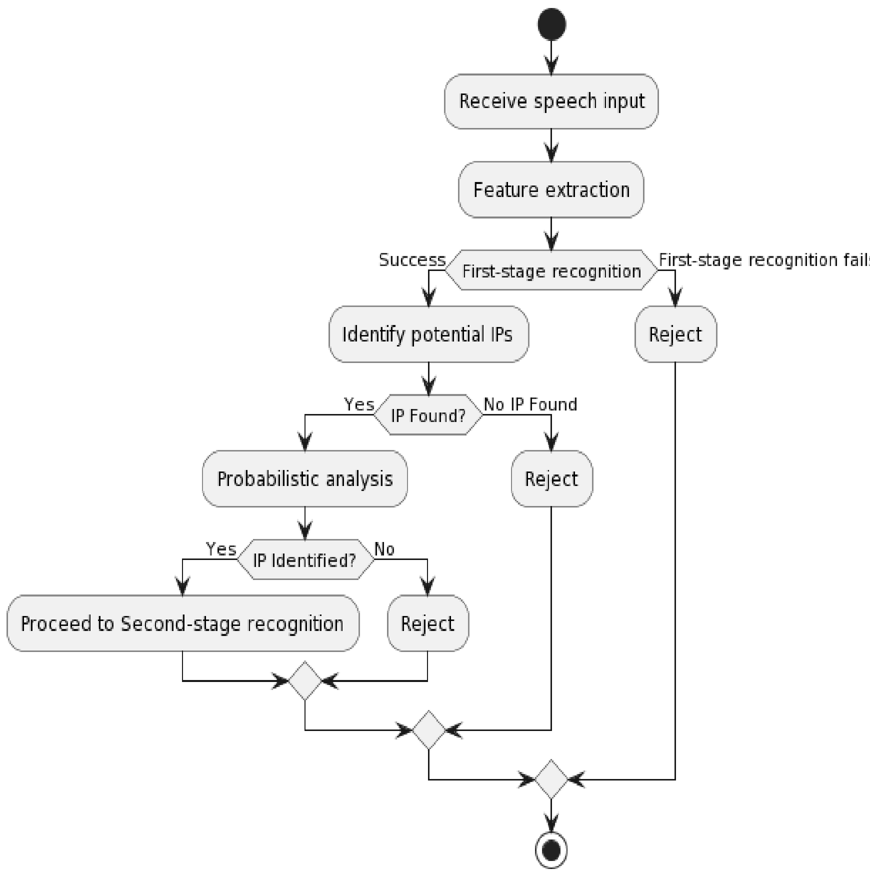


**Figure 2:** A process diagram of probabilistic IP identification in a two-stage speech recognition system.

Greenough, [13] suggest that broad inputs in the external environment are crucial for regulating cortical circuits and that events at critical periods constitute mechanisms of predicted experience. By removing unneeded neurons with a dendritic abrasion-based neural network [13], the resulting shape can be used as a foundation for future constructions. The ability of a person's own unique set of biological facts is referred to as an "experience-dependent" handle in distinguishing. A synaptic connection not being used is formed in response to a situation in which information can be stored. Changes in the future may affect this knowledge. Since both sets of fetuses appear to make identical noise, and the only apparent difference between the two sets is the nature or peculiarity of the boost, involvement must play a role within the differential behavior observed in this scenario. We cannot be sure that the experienced learning in this scenario is predicted or based on involvement because experience desire and experience-dependent forms are unlikely to occur automatically.

Repeated exposure to the mother's voice creates a tool that leads to persistent memories of specific sounds that emerge from pre-birth, experienced forms. Although Joseph [15] acknowledges that reflex brainstem action intervenes and rules human fetal behavior, the hypothesis of Greenough [16] suggests otherwise. Linking shifts in brain activity to improvements in discernment. In the experimental development phase, visual framework research is heavily supported.[17].

However, the visual framework cannot undergo the expected formative development before birth because of the necessity for visual jolts within the uterus. Contrarily, the acoustic stimulation experienced by an unborn child includes the mother's heartbeat, intestine sounds, ambient sounds, and the mother's voice. There are external supports available during pregnancy. A unique neural circuit associated with jolts within the uterus can be shaped by sounds beginning about GA at 30 weeks. A predisposition towards the mother's voice and the ability to distinguish between jarring dialect shifts are present from birth. Their skill set also includes the ability to identify phonemes in languages other than their own. However, with exposure to other languages in the first year of life, children gain the ability to use a second language [17]. Unborn newborns can recognize phonemes in conversation, full-term fetuses have varying responses to mum and stranger voices (discussed in detail here), and preterm fetuses can recognize consonant vowels. Alter. Neurological development in sound-related handling appears to have shifted from experience-independent to expected experience during the final three months of the first year of life while using a foreign dialect once hearing occurs [18]. Wanting new things is a learned behavior that begins in early elementary school.

Throughout the original text, the word "familiar" indicates that a palpable improvement is experienced frequently over time to become known (i.e., no longer novel). Learning and memory are prerequisites for distinguishing between entities. The fetus appears to memorize information about the mother's voice's prosody upon repeated introduction, suggesting brain changes based on maternal discourse if the infant's recognition of the maternal sound depends on prosodic cues [19]. The time of mother sound is during embryonic development. In the context of the present inquiry, differences in heart rate indicate memory and learning due to familiar mother voices and underutilized female voices. The fetus may be able to pay attention to external stimuli for extended periods, as shown by the supported variations in heart rate in response to speech jolts [13] works are silent on the neural substrates underlying memory and attention, and it is currently unknown where these processes occur. We speculate that such a feat may require more than mental prowess and instead point to a few critical drills at the next level. Preliminary imaging studies of the brain provide some support for this hypothesis. Attractive electroencephalography (EEG) is used to consider cortical actuation in the fetal brain, and [20] discovered that the fetal brain's global flap actuation responded to the mother's piggyback virginity tape.[21] duplicated and augmented the work, paying particular attention to the role played by the prefrontal and temporal regions. Our findings thus imply that later-onset fetal discourse processing is influenced by experience and may demonstrate cooperation in fundamental advanced brain work.

Our findings have significant implications for language learning, how first speech perception is theorized, and future studies in these areas. First, it is possible that the groundwork for voice perception and language acquisition was established even before birth, as theorists like [22] and [23] have hypothesized. Second, [24] proposed that the advanced language skills displayed by infants and toddlers might not result from preexisting, inborn speech processing modules in the brain. Contrarily, prenatal exposures may have a significant impact. Finally, at least in the area of speech processing, prenatal involvement of a higher brain structure may be reflected in symptoms of perception, memory, and attention.

**Conclusion:**

This study found that a mother's voice could stimulate fetal heart rate. An unfamiliar voice was associated with a drop in fetal frequency. The experiment was done to influence fetal sound processing since different behaviors have been discovered in reaction to familiar and unfamiliar sounds. It lends credence to the idea that there is some interplay between the genetic expression of brain development and the experience of a given species, which is central to the epigenetic model of speech perception. The results of this study show that a mother's voice has a considerable, stimulating effect on her baby's heart rate. Fetuses showed different physiological reactions to familiar and novel auditory stimuli, including a drop in heart rate when exposed to an unfamiliar voice. These findings show that different behavioral responses to familiar and unexpected sounds provide evidence of the importance of experience in fetal sound processing. The study supports the idea that genetic influences and experiences within a species play essential roles in shaping the brain. The epigenetic model of speech perception relies heavily on this dynamic interaction to explain how genetic predisposition interacts with environmental effects to shape perceptual processes.

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**Author's Contribution:**

The corresponding author should explain the contribution of each co-author thoroughly.

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