

Visual and Auditory Stimuli on Emotional Responses: The Relationship Between Art and Music on Human Emotion

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ABSTRACT

This study investigates the relationship between music and art and their effect on human emotions, identifying what factors may influence the expression of different reactions to various visual and auditory stimuli. An experiment was conducted with a total of fifteen participants between the ages of thirteen and eighteen, with five in each of three groups: group A, group B, and the control group. Participants were tested for a period of one week, with an average of three to four students testing per day after school. Through a thematic analysis of participants' responses to the different stimuli, the findings concluded that both music and art can elicit the exact same emotional responses in adolescent subjects.

Introduction

Throughout history, art and music have played significant roles in human society. Just as how a community is ever-changing, the arts have also transformed to suit the preferences of their enjoyers, which can be seen in the intricacy of the Renaissance Period as well as the abstract quality of modern art. It is common knowledge that both mediums are very much associated with emotion; a depressing song may cause feelings of melancholy, whereas a bright work of art may bring joy.

From the 30,000-year-old murals of the Chauvet Cave to the whistling speech of the Hmong people, the early depictions of the arts were key components of prehistoric communication from one group to another (Balter). Michael Balter, an American science journalist whose writing primarily covers anthropology and archaeology, notes that art may be an expression of a more “fundamental” idea: “the cognitive ability to construct symbols that communicate meaning.” Symbolism plays a large role in the visual art’s ability to transmit ideas to an audience. As illustrated through the previous Chauvet Cave art, depictions of rhinos and other such animals or objects through a variety of shapes and patterns were able to convey different meanings, such as where to find resources or what threats were present at the time.

Likewise, characteristics of music, including rhythm, pitch, and tempo, all possess the same function. Former curator of the Bate Collection of Musical Instruments, Jeremy Montagu, defines music as “[sound] that conveys emotion.” In his article, he explains that music must have a purpose which he identifies as “dance, personal or communal entertainment, communication, and ritual” (Montagu). Many of these purposes overlap with each other—dance may feed into entertainment or communication, and communication may be related to ritual, as the earliest humans attempted to define the world they lived in. As such, “artistic expression,” in both an auditory and visual sense, “may have helped ensure survival of the fittest” through its universal ability to effectively carry meaning across different groups of people without the need for a shared language (Balter).

Universal Quality of Art

Many aspects of music and art are universal; consider colors, for example. In a color study by Professor Helen H. Epps and Assistant Professor Kaya Naz of the University of Georgia, a similarity between people of different cultures and ages showed that the majority felt positive emotions in response to brighter colors and negative emotions in response to darker ones. However, there are minor differences in how people of varying countries and backgrounds perceive certain colors, as culture also plays a large role in color-emotion association. In many eastern nations, the color red represents luck and prosperity, due to influences such as the Lunar New Year, where it has a prominent meaning in auspicious fortune. By contrast, many western countries perceive the color differently, as some may find it a representation of romance instead, due to the correlation between red and Valentine's Day (Epps, Naz). The same pattern can be observed in traditional cultural music as well. While many relate a major key to a more cheerful musical arrangement and a minor key to a more solemn one, that is not always the case. For instance, consider the traditional Japanese folk song "Sakura, Sakura" which is played in A minor, but conveys the beauty of spring. Stacy Lutkoski of American Scientist notes that despite the near-universal qualities of music and art, stronger bonds "between groups that are geographically or linguistically" connected do exist, and specific "cultural traditions [add] layers" to the meanings of emotions that are unique and not felt elsewhere.

Color-Sound Synesthesia

Visual arts are often supplemented by audio effects, which is prevalent in animation, for example. However, the ability to correlate one specific stimulus to another is a strange neuropsychological characteristic—called synesthesia—which is slightly different. Laura M. Herman, author of many articles on synesthesia, describes it as the stimulation of one sense that "causes the automatic experience of another sense." Many types of synesthesia are currently being studied, such as color-sound which Greta Berman, a specialist in 19th and 20th century art and professor at the Juilliard School, defines as "chromesthesia." In her article, Berman notes that everyone possesses a relative synesthesia which can be developed but is very different from how chromesthetes perceive color-sound synesthesia. Many musical composers seem to exhibit chromesthesia; Scriabin, Messiaen, and Sibelius all claimed to have been able to see different colors in correspondence to specific notes (Berman).

Nowadays, both music and art are utilized in a variety of methods in society. Although most commonly seen in entertainment, the arts are also crucial in many other areas as well and have extended far beyond the functionalities identified by Montagu. Such is evident in the medical field where research in art and music therapy has yielded great results for society. The recent COVID-19 pandemic and subsequent quarantine saw artists implementing music and art in the community as well. Through technology, many have taken further steps to incorporate visual and auditory arts into advocating for current events; infographics, educational videos, etc. have all become essential tools for communication and continue to evolve as society progresses.

Literature Review

To determine the relevance of the current study, it is important to first address existing research on the topic. A study by authors Fada Pan and Li Zhang of Nantong University's School of Education Science investigated the effect of music on human emotions and whether visual stimuli supplemented their reactions. Their study consisted of two separate experiments, both of which included undergraduate participants with an average age of twenty to twenty-one (Pan, Zhang). Visual stimuli consisted of picture sources from the Chinese Facial Affective Picture System which showed multiple different human facial expressions (Pan, Zhang). Auditory stimuli included classical pieces that came from a variety of composers and corresponded to contrasting emotions such as happy or sad (Pan, Zhang). The results found that "positive music" caused "significant positive emotion," a trend also emphasized by "negative music" on

“negative emotion” (Pan, Zhang). Additionally, “audio-visual integration,” or the alignment of both the visual and auditory stimuli, “occurred in both the positive” and “negative” music, leading to the notion that perhaps the same pattern could be observed in visual-audio integration: artwork supplemented by an auditory stimulus (Pan, Zhang).

Furthermore, integration of music learning with visual art was once again observed in the students of Glenda Cosenza, assistant professor of music at Northern Illinois University. In her article, Cosenza suggested an activity for elementary or middle school students to visually represent their emotions and/or thoughts relating to certain pieces of music and vice versa, which was intended to “foster a deeper understanding” of both music and art (Cosenza). However, this study never illustrated the full effect of auditory or visual stimuli on the students’ emotions in-depth.

Therefore, the current study attempted to bridge the gap between music and art in order to determine the relationship between their effects on human emotion. Rather than addressing audio-visual integration, the current research aimed to delve into each individual stimulus and find which, if applicable, is more effective in evoking certain feelings. This research was thus unique in that it focused solely on the emotional responses of adolescent students in the United States instead of other demographics.

Hypothesis

Based on the previous studies by Pan, Zhang, and Cosenza, it was suspected that both forms of stimuli would evoke similar emotional reactions in the participants. Additionally, the presence of color would likely play an influential part in this hypothesis, due to its largely universal nature and implicit meaning across cultures.

Method and Design

For this study, an experimental design was most appropriate. Such a design would allow for the study of participants’ reactions in real-time and give the administrator control over aspects of the study that a non-experimental design would not. In this way, one can ensure that results are not skewed by any confounding variables, such as distractions from outside influences during the experiment. The method of the current study was relatively mixed but more inclined towards a qualitative method because of the need for a content analysis of participants’ responses. Due to the experimental nature of the study, it was necessary to take note of the differences in results between each group. The best way to compare these was through an analysis of different themes present in all stimulus materials.

Variables

The dependent variable consisted of the emotional reactions of each group towards the assigned stimuli, which were analyzed through participants’ survey responses after the experiment. By contrast, the independent variables included the different visual and auditory stimuli shown to each group. Manipulating which stimulus material certain groups perceived allowed the researcher to observe and understand the causation and correlation relationships between the effects of the stimuli on participants’ emotions.

Subjects of Study

Participants were crucial to the development of the study because their responses were what determined the correlation between the art and music stimuli. The scope of the study was limited to the population of the designated high school with roughly two thousand students in total, between the ages of thirteen to eighteen. Due to the fact that this was a qualitative study, it was not necessary to pull a large number of participants into the experiment; a sample size of ten to fifteen students was sufficient.

Materials and Procedure

Visual Stimuli

The visual stimulus materials included three artworks, each consisting of abstract shapes, patterns, and colors representing happiness, sadness, and anger (see Appendix A). Words and well-known symbols were not included. All artworks were original creations by the researcher.

Auditory Stimuli

The auditory stimulus materials included three classical pieces representing happiness, sadness, and anger. All pieces were pre-existing works by Beethoven, Du Pré, and Bach and did not include lyrics.

Procedure

All participants were situated in the same classroom but separated based on their dates of availability. In the case that multiple students signed up for the same time, they were seated away from each other to prevent distraction.

The control group was given access to both the visual stimuli and the auditory stimuli. Group A was given access to the visual stimuli only, and group B was given access to the auditory stimuli only. Before the experiment began, all subjects were told to record their current emotional state and its intensity on a scale of one to ten (one being weak, ten being strong) through a digital survey. During the experiment, participants recorded their emotional responses to the stimuli on a survey (see Appendices B and D) using adjectives to describe their feelings.

It was imperative that the participants did not discuss their experiences after their studies in order to avoid potential bias in those that had not yet been tested.

Ethical Consideration

Before participating, students were required to have their parents or guardian sign a legal waiver agreeing to allow their children to participate in the study (see Appendix C). Medical conditions including but not limited to epilepsy or sensitivity to bright colors and/or loud sounds were required to be listed in order to prevent injury. If any of the participants or their guardians felt unwilling or unable to continue the experiment, the student was to be immediately removed from the study. Any identifying student information was removed, and anonymity was ensured.

Findings

A total of five themes emerged as a result of the survey responses of all fifteen participants (see table 1). An averaged calculation of students' ratings of their emotional intensities to each stimulus (on a scale of one to ten) determined whether each theme was relatively 'weak' or 'strong,' resulting in the themes below.

Table 1. Definition of Themes

Theme	Definition
Strong and Negative	Feelings of fear, anxiety, and anger; confusion
Weak and Negative	Feelings of sadness
Weak and Neutral	Feelings of calmness, peacefulness; boredom; nostalgia
Strong and Positive	Feelings of happiness and hope; excitement
None	No emotional response listed

The responses of high school students collected through post-experimental surveys highlighted the emotional reactions of each individual to different visual and/or auditory stimuli. These findings were categorized into four themes (see table 1). Where no emotional response was listed, responses were categorized as “None.” The findings were analyzed for commonalities between all groups through a thematic analysis. Of these, the “Weak and Neutral” and “Weak and Negative” themes were initially meant to be one “Weak and Negative” theme that portrayed sadness but were separated due to an overwhelming number of responses that strayed from that definition.

Recurring theme 1: “Strong and Negative”

The initial “Strong and Negative” theme was intended to display feelings of anger, frustration, and fear. The visual (“Art Piece 1”) used jagged, crisscrossing brush strokes, dark colors such as black, purple, and red, and a tirade of lines cutting across the page in order to resemble these emotions.

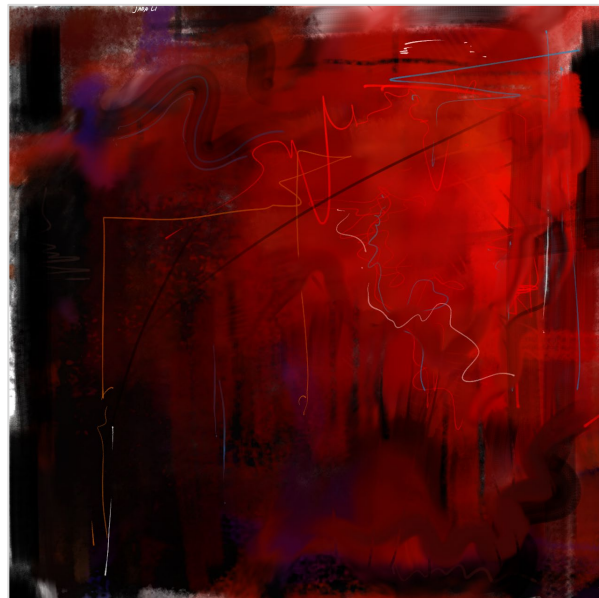


Figure 1. “Art Piece 1”

The audio, Beethoven’s Coriolan, Op. 62: Overture, consisted of growing crescendos that quickly climbed to loud, fortissimo dynamics and sudden bursts of sound from the band and percussion instruments. This material can be found through this link: www.youtube.com/watch?v=DzINFjNPmqI&feature=youtu.be.

From the experiment, three out of five participants in group A reported feeling strong and negative emotions that corresponded with the theme in response to the visual stimuli. One student from group A (see table 2) explained that they felt tense, stressed, and worried as a result of “the color and shading,” which they felt symbolized “a lot of bloodshed.”

Table 2. Group A Participant Response to the First Visual Stimulus, “Art Piece 1”

Participant’s Response to Stimuli	Theme
“Tense/Stressed/Worried, The patterns appear to resemble blood due to the color and shading. There is a lot of red symbolizing a lot of bloodshed.”	Strong and Negative

Five out of five participants in group B responded with the same feelings of fear, stress, and anxiety to the auditory stimuli. Similarly, the results of the control group provided that four out of five participants had such responses to the visual stimulus compared to three out of five in the auditory stimulus. As a result, it can be seen that overall, the auditory stimulus was more effective in transmitting feelings of anger or frustration to the participant. Responses were generally consistent, however. For example, one student from the control group (see table 3) states that the student felt “[anticipation]” due to the “climbing, high, short notes and...strong beats” that helped to create a sense of “tension” and “building emotion” after listening to the audio of the Coriolan.

Table 3. Control Group Participant Response to the First Auditory Stimulus, Beethoven’s “Coriolan”

Participant’s Response to Stimuli	Theme
“Anticipation: the climbing, high, short notes and the strong beats create tension and contribute to a building emotion in this part of the piece.”	Strong and Negative

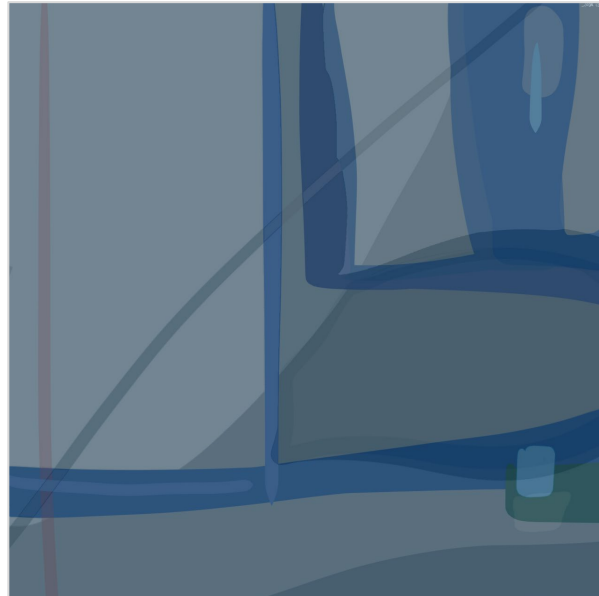
Two of the responses (see table 4) felt that the stimulus made them feel “excited,” one student stating that the piece made “[them] want to dance.” There is the possibility that the term ‘excitement’ could pertain to multiple different meanings based on the audience’s perception, but in the given context of the students’ responses, ‘excitement’ in that respect relates to the “Strong and Positive” theme rather than the “Strong and Negative” theme based on the context of “dance.” Thus, it cannot be said which stimuli brought more influence to the participant’s response.

Table 4. Control Group Participant Response to the First Auditory Stimulus, Beethoven’s “Coriolan”

Participant’s Response to Stimuli	Theme
“I feel excited [because] the music makes me want to dance.”	Strong and Positive

Recurring Theme 2: “Weak and Negative”

One of the less often recurring themes, the definition identifies it as feelings of sadness (see table 1). The visual stimulus for this theme depicted a series of blue, abstract lines of varying lengths and widths crossing a gray background. A single, translucent, red line ran down the left side, while a light blue rectangle was situated in the lower left-hand corner; one may refer back to this work as “Art Piece 2.”



The auditory stimulus was Jacqueline Du Pré’s *Elegie* in C Minor which featured a series of slow, somber cello melodies and a steady piano in the background; this stimulus material can be found here: www.youtube.com/watch?v=oY7aH84PYWY&feature=youtu.be.

Out of group A, only one participant of five found the artwork to give off feelings of sadness, which they credited to the “emotional atmosphere” created by the “blue” allowing the work to appear “really sad and gloomy” (see table 5). The rest of the participants of the same group all proposed that it felt calm save for one other, who offered no emotional response.

Table 5. Group A Participant Response to the Second Visual Stimulus, “Art Piece 2”

Participant’s Response to Stimuli	Theme
“[The] emotional atmosphere the blue gives off is really sad and gloomy.”	Weak and Negative

Fortunately, group B found more success as all students stated that they felt a feeling of sadness or melancholy in response to the auditory stimulus, seen in one student’s response which credits the “slow, vibrato notes” and the “minor key” (see table 6).

Table 6. Group B Participant Response to the Second Auditory Stimulus, Du Pré’s “Elegie in C Minor”

Participant’s Response to Stimulus	Theme
“The emotion felt from this piece was sadness. The slow, vibrato notes made the piece sound somber and sad, along with the minor key. The sustaining of the lower notes created a more full, smooth sound, but the minor sound made the piece more melancholic.”	Weak and Negative

Results in the control group seemed to conflict between the visual and auditory stimuli. All students viewing the artwork concluded with the “Weak and Neutral” thematic responses of calmness or neutrality, while a majority found the Elegie to show characteristics of sadness or longing. Many hypothesized these responses to the song were a result of the “minor keys,” “deep notes,” and “slower tempo,” a pattern consistent with the response mentioned before (see tables 6 and 7).

Table 7. Control Group Participant Response to the Second Auditory Stimulus, Du Pré’s “Elegie in C Minor”

Participant Responses to Stimuli	Theme
“[Sadness] and nostalgia: the longer, slow, deep notes create a calming sense of sadness and also a little bit of regret and nostalgia.”	Weak and Negative
“This song made me feel sad and longing, mainly due to the long notes and minor feel to it. I like it.”	Weak and Negative

Recurring Theme 3: “Weak and Neutral”

The visual stimulus for the “Weak and Negative” theme was not as successful; most students had a difficult time identifying the intended emotion. As a result, this unpredicted result was the driving force behind the creation of a third definition: “Weak and Neutral,” which as defined in table one, applies to feelings of calmness, peacefulness, nostalgia, etc. The stimulus materials pertaining to this theme are the same as those mentioned above (“Art Piece 2” and Elegie in C Minor).

In response to “Art Piece 2,” three out of five students in group A reported feeling calm or relaxed, many explaining that the specific shade of blue or the simplicity of the piece was the reason for such reactions (see table 8). Following that pattern, all of the five students in the control group also displayed “Weak and Neutral” attitudes towards the artwork. Interestingly, one student chose to add that the image reminded them of “a table and chair at school” which could provide insight into how connections made between aspects of the experiment and outside influences could affect their perception of each stimulus.

Table 8. Group A Participant Response to the Second Visual Stimulus, “Art Piece 2”

Participant’s Response to Stimuli	Theme
“It felt very calm and peaceful, I think mainly because of the shade of blue that was used and the darker turquoise in the background. Generally the colors were more softer than the previous piece.”	Weak and Neutral
“This piece of art makes me feel calmer and elicits more positive and relaxed feelings. The color and overall simplicity of this piece makes me feel this way.”	Weak and Neutral

Opposite the previous results, a majority of students did not find themselves exhibiting feelings of calmness or neutrality in regard to the Elegie in C minor, with only one out of five among group B and the control group both. All the participants displayed emotions congruent with the “Weak and Negative” theme; thus, it could be said that the auditory stimulus was less effective here than the visual. However, due to the fact that the visual stimulus was an original work by the researcher who is not a professional in the field, personal bias based on what they perceived to demonstrate a certain emotion could very likely have interfered.

Recurring Theme four: “Strong and Positive”

The most commonly identified theme, “Strong and Positive,” included feelings of happiness and joy as well as hope. The artwork associated with this theme (art piece 3) was filled with brighter colors such as yellow and light blue as well as petal-like shapes and short brushstrokes which many students responded to.



The musical selection was the Bach Brandenburg Concerto No. 3 in G Major by Johann Sebastian Bach, a ‘happier’ piece characterized by its light and upbeat tempo. This piece can be found via this link: www.youtube.com/watch?v=EFRfcWKYZWc&feature=youtu.be.

Out of group A, all of the participants identified the art piece as sharing aspects of the “Strong and Positive” theme. One response stated that the piece “invoked feelings of joy and satisfaction, simply because of the color (bright yellow) and shapes (for some reason they reminded me of citrus fruits).” References to the circular, blooming shapes in the artwork were continuously made as other students pointed out the “tie dye” pattern in its role in influencing their perception (see table 9). Another found that the brighter colors, orange against blue, reminded them of “oranges and the sun,” invoking feelings of happiness and excitement. The same pattern was observed in the control group, with four out of five participants responding with a positive outlook on the work. One student did not offer an emotional response, which was thus categorized as “None.”

Table 9. Group A Participant Response to the Third Visual Stimulus, “Art Piece 3”

Participant’s Response	Theme
“This piece invoked feelings of joy and satisfaction, simply because of the color (bright yellow) and shapes (for some reason they reminded me of citrus fruits).”	Strong and Positive
“The bright colors in the visually stimulating shapes remind me of oranges and the sun which instill a feeling of hope and joy.”	Strong and Positive

The results of the auditory stimulus are consistent with that of the visual stimulus. Of the five participants in group B, four found themselves feeling “joyful” and “happy” because of the lighthearted rhythm and higher notes. One participant noted that the song reminded them of happy memories in their life and reminded them of “exciting times,” which as mentioned above, illustrates the connection between individual experiences and the stimulus. All in the control group identified the piece as “Strong and Positive” as well.

As such, recurring theme four was the easiest to identify a clear trend. All participants reported feeling “happy” or “joyful” emotions in response to both the visual and auditory stimuli. Further, a tendency to connect certain aspects of the stimuli to past experiences in their life was observed as a result. Some students noted that the round, brightly colored shapes in the “Art Piece 3” piece resembled citrus fruits, flower petals, suns, etc., most of which conjured positive emotions. One student stated “[this] artwork also reminds me of Fiori di Como (Chihuly Art), an artwork I really like.” Another offered that “the patterns” in the visual stimuli reminded them of tie-dye, which according to them, “is a fun activity to do.” Again, it is possible that such observations prompted bias in the viewers—their opinion of a familiar artwork could have influenced their perception of the current stimulus.

Discussion, Analysis, Evaluation

Implications

Overall, while it is not apparent which stimulus was more effective in producing certain emotional responses, a comprehensive analysis of the results of all three experimental groups reveals that the initial hypothesis was correct. Based on the responses given by the participants, it can be concluded that both auditory and visual stimuli—music and art—share the same ability to invoke vivid and intense emotional reactions in humans.

Limitations

The presence of limitations regarding the experimental process could have greatly affected the findings and results. Firstly, a smaller sample size of fifteen is adequate for a qualitative study, but the involvement of a larger number of participants would have increased the credibility of the findings and provided a more overarching conclusion for the study.

Secondly, due to the smaller sample size, any human error involved would lower the accuracy of the experimentation, as seen in how some students failed to provide responses to certain survey questions—likely due to misinterpretation of the question. For example, when asked the question, “Describe the emotions you experienced following the stimulus. Rate the intensity of the emotion on a scale from one to ten, one being weak and ten being strong. What aspect of the stimulus made you feel this way,” one student responded with “9, the color and the lines.” The question was left partially unanswered and thus could not be used as it did not identify an emotion linked to the result of the experiment.

Thirdly, the experimental environment was important. As it was impossible to ensure that all aspects of the students’ environments were identical prior to the experiment, the researcher was only able to control the classroom where they conducted the study, meaning that students’ initial emotions could vary. Most of the participants reported feeling stressed, excited, or neutral before beginning the experiment; thus, differences in starting attitudes could have played a role in the results of the study.

Lastly, the existence of bias was an issue. Because the auditory stimuli used in the study were not original works created by the researcher but pre-existing classical pieces, there was the risk that some participants would already be familiar with the stimuli, which could skew results. One student reported feeling excited and happy to a specific stimulus they recognized, while others shared contrasting opinions. In this way, it is possible that bias could have significantly altered the credibility of the responses but is outside of the researcher’s control. Similarly, the original art pieces were also subject to bias based on the researcher’s own perception of certain emotions. For example, “Art Piece 2” was meant to reflect a sad, melancholy mood, but many participants perceived it as calm and neutral. As such, the researcher’s own bias influenced the results as well.

Future Research

The findings of the current research can be implemented in society in a variety of ways. Most notably, the usage of the data presented in the study can be utilized through the design of public spaces and office buildings, etc. In the *Journal of Indian Society of Pedodontics and Preventive Dentistry*, authors Umamaheshwari, Asokan, and Kumaran suggest that “dental anxiety,” specifically, is a significant issue that can greatly impact a “child’s behavior” during a visit. As a result, the implementation of calming colors such as yellow or light blue as well as corresponding music can foster calm or happy emotions in patients. This is especially important for high-stress locations such as urgent care facilities or emergency rooms. Similarly, the construction of learning environments within the education system may also find such data useful. Due to the fact that the current study focuses solely on adolescent individuals of a certain age, research of different age groups and demographics may be beneficial, such as study on the effects of visual and auditory stimuli on younger children or even infants. Further research could be conducted on animals as well—pets especially could greatly benefit from such findings which could aid in animal rescue or therapy.

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