Colors of Hearings: A Subjective Experience of Synesthesia Among Six Siblings

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Summary

Current research aims to explore, understand and describe the subjective experiences of synesthesia among six self-reported synesthete siblings. We conducted two studies, one quantitative and one qualitative, for this purpose. The first study aimed to measure whether six siblings actually had synesthesia experiences. Six synesthete siblings and their eighteen non-synesthete peers participated the study 1. First, participants filled out the Eagleman Synesthesia Test Battery - Synesthesia Type Scale. Then, we asked the participants to match some words that we randomly selected from the Turkish dictionary with colors on a color scale. Both cross-sectional and longitudinal compositions showed that six siblings matched words with specific colors compared to their non-synesthete peers, and these colors hardly change over time. In study 2, we interviewed these siblings and aimed to investigate their synesthetic experiences using an interpretative phenomenological analysis approach. We verbatim transcribed the interviews, and results showed that three main themes emerged, which were: (1) The nature of the synesthesia experience: Is it really rare?, (2) Details of the synesthesia experience, (3) Time and experience: It can change. The third superordinate theme has a subordinate theme, which is the stability of the associated colors within participants. We discussed the findings in the context of the persistence and changeability of the synesthetic experience and the uniqueness seen among siblings even when raised in the same environment.

Keywords: Synesthesia, Synesthetic experience, Grapheme-color synesthesia, Interpretative phenomenological analysis, Color perception

INTRODUCTION

Synesthesia is a condition that includes a rare and subjective way of sensing the world. It is defined as the production of a sense impression relating to one sense or part of the body by stimulation of another sense or part of the body, which means *joined sensation* can be exemplified as that the music is not only heard but also seen, taste sensation can also be felt like a physical touch (1). It is a rare perceptual condition in which a specific stimulus is experienced by at least more than one sensation (2). The prevalence of synesthesia is 1/25000 or 100000 (million) adults (3). Moreover, recent studies showed that approximately 2-5% of the population experience synesthesia (4,5).

It has plenty of several forms defined from 60 to 150 versions, including auditory stimuli trigger visual stimuli in the form of color, shape or tactual sensory or tasting sensory (1). For instance, hearing stimuli may lead to the experience of a color. Meaning, auditory stimulation can result in visual stimulation. This form of synesthesia is the most common form called grapheme-color synesthesia (6). In accordance with Day's self-reported research, 40% of synesthetes see *with their ears* (7). Individuals with grapheme-color synesthesia can experience colorful visual displays in result of the varied auditory stimuli, such as vowels, complete words, musical notes, and other sounds which non-synesthetes will find so fantastic even to imagine (3).

Synesthetic experience may occur as a result of a genetic heritage that is monitored in the other family members (8,9). Heritage is carried with a sex-linked genetic mechanism which explains that women lead the sex ratio (6/1) in synesthesia according to some views (8,10,11). The studies focus on synesthesia is mostly bringing neuroscientific explanations of the synesthesia mechanism of by using neural measurement techniques and quantitative research methods (2, 12-18). On the contrary, there is few studies focus on the subjective meaning of synesthesia among people who share the same genetic heritage and similar environmental factors. Subjective synesthesia experience from a sample that shares similar genetic and environmental factors, such as *siblings*, may reveal similar and different characteristics of synesthesia that have not been expressed until now.

In this research, we aimed to understand the shared similarities and differences in the synesthesia experience, based on the subjective experiences of 6 synesthetic siblings who grew up in a similar environment, and thus to describe the subjective synesthesia experience that has not been empirically tested among family members in the literature to the best of our knowledge.

STUDY 1

Synesthetic perception is sometimes confused with people's own subjective experiences. Therefore, in studies conducted with individuals who state that they have experienced synesthesia, it is primarily examined whether these individuals have experienced synesthesia (4). In our first study, we wanted to examine whether six siblings that we reached through our personal connections and who stated that they had synesthesia (grapheme-color type) really had such an experience. To do this, after asking both groups to indicate whether they experienced synesthesia on a scale, we asked them to match the words in a list of 100 words with the colors on a 200-color chart at two different times. Here, we aimed to see if the synesthetes-experienced participants, compared to the non-synesthete group, consistently matched words to a specific color, that is, to test whether they actually experienced the words they read as a colored auditory stimulus.

Method

After obtaining ethical approval, six synesthete siblings (2 male, 4 female) aged between 24-42 ($M_{age} = 32.83$) and their 18 non-synesthete peers (5 male, 13 female) aged between 18-62 ($M_{age} = 32.11$) participated in study 1. Non-synesthete participants reported they have no person with synesthesia in their family. All participants are right-handed and spent most of their lives in a city. No participants indicated that they were diagnosed with a brain tumor, epilepsy, migraine, or learning difficulties like dyslexia, dyscalculia, and dysgraphia.

Eagleman Synesthesia Test Battery - Synesthesia Type Scale was used to measure whether participants experience any type of synesthesia (19). It is a self-reporting scale consisting of six questions. A list that includes a hundred words was created to examine whether the participants with synesthesia made more consistent word and color matching than the other participants. The words were randomly selected from the current Turkish dictionary. Unified words (e.g., like *ayakkabi*, it means shoe but in Turkish it consists of 'foot' and 'container' words), words which directly include (e.g., *bembeyaz*, it means snowwhite) or evoke (e.g., like *aslanağzı*, it means antirrhinum but in Turkish also there is a color called 'aslanağzı') color name, prepositions like to (in Turkish "için") and conjunctions like or (in Turkish "veya") were removed from the list. After that, the process of randomly selecting words continued until the list had 100 words. A simple HTML 5 color table which includes 20 columns, 10 lines, and 200 cells, was used to carve out the color chart. It was presented on a sheet of A4 size paper, and each cell covered approximately 220 square millimeters area (1.3 x 1.7 cm). The word list and color chart are presented on <https://osf.io/r8c4g/>

The aim of the research was announced on the internet page of the department to find non-synesthetes participants. We gave an appointment to the non-synesthetes via e-mail. First, informed consent was obtained after the procedure had been fully explained. Then, the demographic information form and the Eagleman Synesthesia Test Battery were presented. Second, we gave them a color chart in which we wanted them to indicate a color for each word. This procedure took approximately 45 minutes. We gave them another appointment for a second measurement of word color matching at the end of this process. In order to minimize the recall effect, the positions of the words in the word list in the second word-color matching task was randomly changed and read after the time duration from at least 15 days.

Results

Six siblings (100%) expressed that they experienced grapheme-color type synesthesia, although only five participants among non-synesthetes (28%) stated it. The z-ratio test (20) indicate that participants with synesthesia stated more grapheme-color type synesthesia experience, $z = 3.07$, $p < .01$.

The difference between the first and second word-color matching measurements of the participants is assessed as a score of the synesthesia experience. The lower difference between the two measurements indicates a higher probability of synesthesia. The difference between six siblings who experience synesthesia and their eighteen peers in terms of the score of synesthesia is analyzed by Student's T-test. Results showed that six siblings' word-color matching score consistency between time 1 and time 2 is greater than non-synesthete group, $t(22) = 10.77$, $p < .001$. Moreover, we examined consistency among six siblings, and found

that it changes within siblings, Selim ($\Delta WCM = .99$), Sevgi ($\Delta WCM = 1.11$), Ahmet ($\Delta WCM = 1.82$), Hale ($\Delta WCM = 1.97$), Gülhan ($\Delta WCM = 3.49$) and Deniz¹ ($\Delta WCM = 3.64$).

Discussion

Findings from both the Synesthesia Type Scale and the word-color matching task suggested that they experience grapheme-color type synesthesia, as six siblings self-reported. As stated in the literature (3-4), the most common type is grapheme-color type synesthesia. In this study, participants who experienced grapheme-color type synesthesia, which is the most common type, were reached. Even if they did not experience synesthesia, 5 people on the scale stated that they may have experienced simple type synesthesia in their past. In the literature, it is stated that there may be people who can express that they have had such experiences, even if they are not synesthetes (3-4). Therefore, using matching tasks instead of self-report measurements may give more accurate results in such studies.

Six siblings gave nearly the same answers in the word-color matching tasks at two different times. For instance, if a sibling preferred a shade of green among 200 colors for the word *ayıplamak*, which means *to shame* in Turkish, she or he preferred almost the same shade in the second measurement. The lowest deviation mean is .99 and the highest deviation mean is 3.64 in a score with a range of 0 and 27. This finding may show that grapheme-color type synesthesia is not a side effect of subjective experience and that participants actually experience the words they read intensely in color (21).

STUDY 2

There are very few studies describing synesthetes' subjective experiences, while there is a great deal of focus on topics such as their memory and perception processes (22) or related to art (31). However, revealing the synesthesia experiences of people who share similar genetic and environmental factors may enable the neuropsychology field to focus on the commonalities and differences in these experiences. For instance, are negative words perceived in similar colors? Do verbal concepts differ more among individuals who share similar genetics than mathematical ones? Does autobiographical memory differentiate the color perception of words among synesthetes? Such questions can only be answered and described by in-depth analysis of qualitative data to be obtained through face-to-face interviews; thus, future studies may focus on the function of different brain regions in individuals experiencing synesthesia. Therefore, in the second study, we conducted semi-structured interviews using interpretative phenomenological analysis (IPA) with the participants and aimed to describe the participants' subjective synesthesia experiences from different perspectives.

Method

Six siblings in Study 1 participated in this study. Two of them were graduated from college and others from elementary school (Derya, Gülsüm, Seher, Amil). The demographic characteristics of the participants are presented in Table 1. All siblings declared that they all spent their childhood and adolescence period together. The sample size was congruent with the IPA guidelines. As IPA is an intensive and detailed analysis of cases, small and homogeneous sample are preferred (23). As our sample consists of family

¹ Names are presented as pseudonyms to protect participants' anonymity.

members, it is regarded as the genetic pool, and shared environmental factors increased the homogeneity of the synesthetic sample.

-Insert Table 1 about here-

We followed the basic principles of IPA and prepared a semi-structured interview form. Topics covered demographic questions, the realization of having synesthesia, effects of synesthetic experience on their life, thoughts, and feeling about having synesthesia. Each participant was taken individually into the interview room. Informed consent was obtained after the procedure had been fully explained. The interviews lasted approximately 35 minutes.

We audio-recorded the interviews and verbatim transcribed them. Double-hermeneutics, which is a two-step interpretation of the phenomena, was used in the analysis process (23). The themes repeating among the interviews were noted, and superordinate and subordinate themes were constituted. In the next phase, the procedure was repeated for each case separately. After coding of interviews, the researchers studied on together on the transcriptions, and they decided to the superordinate and subordinate themes with a consensus.

Results

We found three themes which are: (1) The nature of the synesthesia experience: Is it really rare?, (2) Details of the synesthesia experience, (3) Time and experience: It can change. The third superordinate theme has a subordinate theme, which is the stability of the associated colors within participants.

The Nature of the Synesthesia Experience: Is it Really Rare?

The nature of the experience was somehow different among participants. There were variations among participants in terms of being unaware of the frequency of the experience, and as well as denying the rarity of the experience, as they took it for granted. The respondents were unaware of their dual sensation experience before their brother told them that it was an unusual way of sensing the world.

I have realized it while I was reading the chapter related to synesthesia from a cognitive psychology book. Actually, I was aware of my experience; however, I was not aware that the others were not experiencing it this way. Ordinary people do not have synesthesia. (Selim, male, 28 years old).

The participants stated that each sibling learned that they have synesthesia from Selim:

I had realized that I had synesthesia when my brother was studying psychology and learned it at the university. Then, he shared it with us in our family group on WhatsApp. If my brother had studied law instead of psychology, for instance, maybe we would never learn anything about synesthesia (Hale, female, 24 years old).

The participants of the study denied that there was something particularly outstanding about their experiencing colors by means of hearing. Even after the respondents learned that their experience was unique and rare, they denied the idea that the others around them did not experience the world the way they did each day. They all assumed that each person had some kind of multi-sensing.

I thought that everybody has this way of sensing, but maybe most of them are unable to define their experiences or to tell each other about this experience. I thought that maybe there is no such thing, or it is just related to communication differences (Selim, male, 28 years old).

I have learned that others do not have it like us. I was assuming that everybody had it. I still do not believe that. I cannot believe that they do not associate a word with a color when it is said. How can they not associate a word with a color? If I say ten words, how come none of them are associated with a color (Sevgi, female, 38 years old)?

Another example of denying the synesthesia experience was stated as follows:

I was sure that the others had it, even if my brother said the opposite. Then I have realized that they really do not have it. I did not believe this for a while. Then, I told my friends that I had such an experience. Most of them reacted to me like, what are you talking about, and told me it was nonsense. Mainly, my husband, when we were just friends, did not even want to talk about it. For instance, I do not want to talk about these issues with my older brother, as he thinks things like that are nonsense and unnecessary (Hale, female, 24 years old).

The Details of the Synesthesia Experience

The second superordinate theme of the analysis involves the determinants of associated colors for the words. Even though synesthetes had difficulty in explaining what may determine the color of what they hear, we found that there were particular factors that affecting the color associations, including the dominant letter, the frequency of hearing, the style of the stimulus, the meanings of words, a phoneme of the words and past experience.

I have realized that the color is a combination of the dominant letters most of the time; however, there are also (colors that manifest independently) from those dominant letters. Maybe sometimes it is just related to the meaning of the words (Selim, male, 28 years old).

Some respondents stated that the color associated with what they hear is more likely to depend on the dominant letter rather than the meaning of the words, unlike the associations of non-synesthetes. The following excerpt from Ahmet illustrates this:

The color of the word bravery [in Turkish ‘cesur’] mostly depends on the dominant letter of it. Such as C or R. If the letters exist and if there are more in it, they determine the color of it. However, they are not the main colors; they are just in between the main colors (Ahmet, male, 42 years old).

Additionally, some participants declared that the associated color of the digits may vary when seeing them written as a digit, such as 3, and three and also when they hear the phoneme three. As this situation is just ascribed to certain specific numbers ranging from 1 to 10, we regard this as experiencing color differently than what they are hearing (seeing) may also be related to the frequency of hearings the stimulus.

Thirteen as a word was not associated with any color, but 13 as a number, is associated with white, black, and the color of water (Deniz, female, 30 years old).

Meaning and phoneme are the other determinants of the associated colors, according to participants of the research. While some were affected by the meaning of what they heard, some others were more likely affected by the phoneme of the hearings when it comes to what determines the associated colors. The following excerpt from Deniz exemplified this:

‘Yüz’ [a homonym for the words hundred and face] has a different associated color when I hear it. ‘Yüz’ [meaning hundred] is white, but ‘yüz’ [meaning face] is more likely a golden color (Deniz, female, 30 years old).

Deniz and Selim clearly stated that they were also affected by the meaning of the words from time to time. Besides, this does not mean that words with the same meaning have similar associated colors.

‘Gül’ [a homonym for the words meaning laugh as a verb and rose as a noun] has been associated with different tones of brown. Sometimes, the words, which have very different meanings, may mix in my mind as they are similarly associated. It also happened while I was learning English. In the beginning, there was no associated color. The colors became more accurate with time. Then, the words became blended in my mind as they have similar associated colors (Selim, male, 28 years old).

On the other hand, some respondents stated that they were affected by the phoneme or what they were hearing.

When I hear that ‘meow’ sound from a cat, it is yellow; however, if I hear someone say the word ‘meowing’, it is blue (Hale, female, 24 years old).

‘Yüz’ is always the same and independent of its meaning (Ahmet, male, 42 years old).

It does not matter whether it is a digit or written; I always think while I hear. ‘Ahmet’ [a male name in Turkish] was white; it is still white. It also does not change even if I do experience something negative (Gaye, female, 27 years old).

Time & Experience: It Can Change!

The dynamic nature of the phenomenon was also emphasized by the participants. For instance, Selim stated that the frequency of the words they hear might affect the accuracy (possibly the specificity) of the associated color. In addition to the frequency, Selim also adds that abstractness and length of the heard word may also determine the accuracy of the associated color. Selim stated that:

If the words are abstract, too long, or not frequently used or heard by me, the colors become less accurate. I can say that most of the time, this ambiguity is going to result in brown or black. Especially if they are abstract rather than concrete, they become more ambiguous. The words used frequently in daily life and the names are the ones that I can quickly respond to. For instance, I can tell the colors of the names within a short period. However, if they are abstract or too long, like the word unpretentious, I cannot imagine the color in my mind. A color appears, but it is very unclear. Alternatively, for instance, digits and frequently used numbers have specific colors. I mean sixty, ninety, fifty have colors; however, eight hundred and sixteen does not (Selim, male, 28 years old).

Another determinant of associated colors is the experiences that they had. For instance, Sevgi claimed that experiences might affect perceptions of associated colors:

Colors might change with the experience, whether it is something good or bad. Not really much; however, it changes over time. It might also turn out to be another color. For instance, while it is red, it might be green, or while it is red, it might be a lighter red (Sevgi, female, 38 years old).

Hale had a specific example of how the associated color of a word can change:

Even though most of the names are still the same for me, I have a specific example for you. My husband's name is Cem. I think of Cem Yilmaz [a famous comedian in Turkey]. The word Cem was a light color for me. However, after I started to date my husband, it started to become darker for me (Hale, female, 24 years old).

Moreover, Selim speculated that some other shared experiences might be responsible for the associations:

I am not sure, but I think there was someone called X [the first name of one of the authors] in our village. Somehow, we all are associating your name with yellow even though the shade of it varies among us. Especially the words I had learned before I went to school might determine the colors of letters and digits for me. For instance, Rasim [a male name in Turkish] is blue. Light blue is R for me. Rasim is the name of my father. Alternatively, Ankara [the capital city of Turkey] is blue, İstanbul [the most crowded city of Turkey] is yellow for me. For example, Ankara might be affected by the colors of 'Ankaragücü' [the football team of Ankara City] and İstanbul from 'İstanbul Spor' [the football team of İstanbul City]. I can even guess that B, and Bursa [one other city of Turkey] might be affected by the green uniforms of 'Bursa Spor' [the football team of Bursa City] (Selim, male, 28 years old).

Stability of the Associated Colors within Participants

Synesthesia experience is stable, but it may or may not change within and between individuals over time. Most of the respondents of the study clarified that the associated colors of their hearings are stable over time.

I had realized that I had never thought about these and spent my time thinking about them. Ankara [capital city of Turkey] was red when I was a little girl. Because the letter 'A' was red. It was a dark red when I was a little girl. However, now, Ankara is more likely associated with the color black. Maybe I was not stressing the letter 'K' like I am doing it today. It was red when I was 8 or 10 years old, but now I am saying it as anKara ['Kara' means black in Turkish]. Maybe this is because of that meaning can affect the change of associated colors over time). However, they may change with the events or experiences depending on whether it is good or bad. Nevertheless, they are not much. The color might exactly change depending on my happiness level. Red may turn into green in time, yes. The color I look at the people might also change (Sevgi, female, 38 years old).

My experience is stable and will never change. So, there is no need to argue about it with others. I have never experienced it as if the brightness of colors has changed. When I looked back, yeah, sickness is yellow and still yellow to me. So, the colors are not changing (Gaye, female, 27 years old).

The way I perceive the colors was always stable since my childhood. Selim always has the same associated colors; Rasim is still the color of the stone, the same as in my childhood days (Deniz, female, 30 years old).

The colors have always been the same since my childhood. Selim's color was light brown, and it is still the same light brown even if the words are homonymous (Ahmet, male, 42 years old).

We shared coding of transcriptions, subordinate themes, and superordinate themes with Selim as he is also a psychologist experiencing the phenomena to increase trustworthiness. He declared that the themes that emerged in the data analysis process are appropriately covered their synesthesia experience.

Discussion

The findings were primarily coherent with the literature. Many individuals with synesthesia become adults without becoming aware that their experience is something unusual (1). In this study, respondents were not aware of their way of multi-sensing until their brother (Selim) told them about synesthesia. The rate of experiencing synesthesia in the nuclear family was high (7/10; i.e., seven of eight siblings stated that they experience synesthesia). One sibling expressed that he did not feel any synesthetic experience. We did not have enough information about the parents' synesthesia status. They may be assuming that most people have it, and a few of them did not have it, or they may be too shy to be explicit about it.

On the other hand, the literature also indicates that some synesthetes have been shocked to realize that most people do not experience this kind of multi-sensing (1). Cytowic (24) gave an example in which a color-hearing synesthete could not believe that there were more people with the same condition. She assumed that she was insanely imaging hearing colors. She was also denied her way of experiencing sounds by blaming herself for being insane or imagining. Moreover, such rejection may be the result of not wishing to see themselves as members of society deviating from the norms associated with perceptions of the world and reality.

Similarly, people were prone to denying the diagnosis upon learning that they have synesthesia (25). The participants insisted that the others were also seeing colors whenever they heard something and that this was not peculiar to them. They not only did not see themselves as a part of a minority through the denial strategy but also refused to see themselves deviating from the norms of society.

Moreover, the available research supports the claim that there can be individual differences from one person to another in grapheme-color synesthesia (1, 26), which was corroborated by our respondents' way of experiencing and the way they interpreted their experience. They were able to experience colors in their mind's eye or on an internalized space which is called associators rather than seeing colors outside which is called projectors (26). The participants declared that they do it with their mind's eye. Even if our respondents were family members, shared a similar genetic pool and environment, determinants of associated colors varied among participants. Some studies revealed that the genetic pool of synesthesia is heterogeneous and polygenetic (9). The answer might be related to shared childhood experiences, which our participants also mentioned that they were grown up together and in the same village. Chin and Ward's study (27) on autobiographical memory revealed that childhood memories might have particular neurodevelopment importance in synesthesia. In addition, Dixon et al. also claimed that the associated colors were determined by the subjective meanings of the words, not only by the graphemes themselves (28). All in all, it might be inferred that synesthesia is a condition affected by the sum of individual, environmental, neurodevelopmental factors rather than just only genetic ones.

Similarly, the color associated with the sound for the word 'Cem' changed when Hale got married to a man named 'Cem.' Root et al. claimed that some letters are associated with the same color in plenty of

languages (32). Even though our respondents were siblings with a shared genetic pool and environment, they experienced varied associated colors when they heard the same sounds. However, Mankin and Simner claimed that some letters were represented by the colors of the prototypic words; for example, 'A' for 'apple' can be associated with the color red (33). Selim declared that a similar association existed between the colors of the football teams and the relevant cities' colors. In addition to the individual differences, Drew et al. stated that synesthesia is a two-way process, which means that seeing a letter not only causes the experience of a color but that seeing a color also causes the experience of letters, words, and their meanings (34).

Moreover, Miozzo and Laeng stated that Saturday could be associated with a different color depending on whether it was regarded as a day within a week or as a day within a month (35). The research also supports the idea that written and spoken words can differ in terms of their associated colors. In another study, Hamada et al. declared that visual shape, ordinality, and frequency are the factors that affecting the associated colors in grapheme-color synesthesia (29). Some of the respondents also reported that they were affected by the meaning, and some of them reported being affected by what they heard as a phoneme. Similarly, the literature supports that synesthetes can be sensitive to the polysemic variability of homographs that are also homophones; for instance, 'yüz' elicits one color when it means 'face' and another when it means '100 (hundred)'. In addition, some of the participants in this study stated that they are not just affected by the language that they hear but that they can also be triggered by animal sounds (such as the sound of a cat's meow). The literature supports the idea that sounds dog barks, clattering dishes, and especially music can trigger synesthetes. However, there was no clear explanation of why synesthetes were triggered by some sounds but not by others (1). Miozzo and Laeng stated that the way the sounds are experienced, such as by hearing or reading, might also cause the experience of different colors, even if the words are the same (35).

In a quantitative study of Baron-Cohen et al., it is claimed that synesthesia is consistent over time (21). On the other hand, the longitudinal study of Simner et al. supports the idea that the quality of the synesthesia experience changes over time (30). The findings of both of these studies are congruent with our own findings. Moreover, Rogowska declared that while most of the synesthetes' experiences of associated colors were congruent across time, some stated that those experiences could be changed, weakened, or strengthened, as shown by examples in our study (26).

For most participants, it was their first time thinking about how they perceived the colors of what they heard and how they evaluated this experience. As this phenomenon characterized their way of sensing from the time they were born, it seemed like they never needed to tell about this experience to non-synesthetes. Furthermore, we observed that as the education level of the participants declined, the length of interviews and quality of responses decreased. Therefore, we inferred that education level might be related to giving meaning to their experiences and explaining them in a detailed and structured manner.

IPA was based on transcriptions which means the methodology was based on verbal data. The education levels of participants were low which might affect the length of interviews and data quality negatively. Therefore, further studies might investigate synesthesia among different samples, specifically, participants from higher educational backgrounds.

Synesthesia is a complicated, subjective way of multi-sensing phenomena, which awakens similar feelings in people who have it. On the other hand, the way of experiencing it and the factors contributing to it are unique, and grasping the phenomena is still complicated. Though there are many studies focused on the brain mechanism of synesthetes by using neurological measurement methods, few is investigating the experience of synesthesia (22). Hence, there is room for more investigation and better understanding when it comes to individual differences in synesthetic experiences. Qualitative methods, especially IPA, could facilitate understanding experience by in-depth interrogation. This study initially provides shreds of evidence of how synesthetes experience synesthesia by using IPA. Exceedingly, homogeneity of participants, which are sibling sharing genetic compounds and similar environmental factors, strengthened the sampling of study while demonstrating broad individual variability in synesthesia even among them. The current study also aims to demonstrate that the effects of an individual's perceptions can be interrelated, which may contribute to many different fields such as cognition or communication. In addition, synesthesia is a multi-layered way of feeling sensations simultaneously; therefore, it may be appropriate to investigate synesthesia using information processing models. Synesthesia is an experience that is monitored and evaluated by meta-level processes.

Moreover, as synesthesia can be evoked by psychoactive drugs (called narcotic synesthesia) (26), it should also be understood better to enhance understanding of addiction psychology and to promote the discovery of a more effective way of taking precautions against the need for addictive substances. Besides these, to the best of our knowledge, this study is the first one that investigates synesthesia within a family from an IPA perspective. Further studies might investigate the synesthetic experience from different perspectives. Their experiences might contribute to different disciplines such as physics, neurology, or engineering.

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Table 1. Demographic characteristics of the participants

Pseudonyms	Gender	Age	Marital Status	Education Level	Occupation	Perceived SES*
Selim	Male	28	Single	Undergraduate	Psychologist	Middle
Hale	Female	24	Married	Undergraduate	Teacher	Middle
Deniz	Female	30	Married	Elementary school	Housewife	Low
Gülhan	Female	27	Married	Elementary school	Housewife	Low
Sevgi	Female	38	Married	Elementary school	Housewife	Low
Ahmet	Male	42	Married	Elementary school	Worker	Low

Note. SES = Socioeconomic status