

The Effects of Music Type on Picture
Perception: A Review of the Literature

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Running Head: SYNESTHESIA EFFECTS

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The Effects of Music Type on
Picture Perception

One may experience sensory blending in which sound may produce not only sight but also taste. This blending of the senses is called synesthesia. There are many types of synesthesia since any or all of the five senses may be simultaneously involved. The most common varieties are visual images aroused by sounds (colored-hearing) and visual images produced by taste (Marks, 1975).

An early definition of synesthesia describes it as a phenomenon characterizing the experiences of individuals, in which sensations belonging to one sense attach themselves to sensations of another group and appear regularly whenever a stimulus of the latter type occurs (Karwoski & Odbert, 1938). This definition suggests that synesthesia is a product of perception from one sense modality. Contemporary theorists believe this definition of synesthesia is too rigid. A broader definition may include phenomena like the joining of the senses, meaning that synesthesia reflects a presumed connection among attributes from

different sensory modalities (Melara & O'Brien, 1987, Marks, 1987). Individuals claiming to be synesthetic reported sounds arouse visual images whose color, brightness, and shape all vary with the pitch, loudness, and tempo of the acoustic stimuli (Marks, 1975). They also reported that high pitched tones correspond to a bright color, not a dark color. The high tone and bright color are said to be "synesthetically congruent" meaning that for some subjects these attributes "match" phenomenally. Although synesthetic experiences of these sorts are rare, Marks (1987) suggests that there may be an existence of a more universal cross-sensory undercurrent running through the perceptual experience of the non-synesthetic as well as the synesthetic perceivers.

Melara and O'Brien (1987) also believe that synesthesia is not solely an experience of few people. They view synesthesia as a phenomenon based on shared figurative cross-modal similarities. Figurative similarities indicate that certain cross-modal attributes, although having no physical (literal) similarity, may nonetheless be phenomenally related. They believe that the intrusion

Synesthesia

4

of internal, phenomenal sense information upon external, attended information creates an experience close to the perceptual experience.

Past research has used short musical excerpts and tone stimuli to study the phenomenon of synesthesia. Music has been used in the cinema and advertisements over the years to modify the reactions the individual has towards them (Huron, 1989). For example, music is used to heighten the individual's reaction to a frightening scene in a movie thereby enhancing the perceptual experience of fear. The use of music in these areas suggests a link between music as a modifier of experience and the phenomenon of synesthesia.

A number of researchers have examined the phenomenon of synesthesia. Research in synesthesia has been subjective or observational in nature using tones or short musical selections and asked for introspective reports.

Some of the earliest studies of color-music relationships were performed by Karwoski and Odbert (1938) when they asked introductory psychology students to report in detail the nature and type of color response they experienced when they listened to a particular

selection of music. Karwoski and Odbert then classified the individuals into different groups depending on the nature of their particular "type" of synesthetic report. They found that there were several different patterns. Some subjects reported that their color response to music was similiar to a film or cloud, while others described theirs as "spreading sheets of color that overlay one another" (Karwoski & Odbert, 1938). Others described their response as a band of color that varied in its width, degree of color, and movement that was almost always in a left to right direction that ocurred along with variations in the music.

Karwoski and Odbert also found some individuals reported having meaningful images as a response to a particular selection of music. By meaningful images they meant some subjects in response to the music saw elaborate pictures, or scenes, for example one individual saw what he believed to be a snow covered mountain scene. Karwoski and Odbert stated that synesthesia and meaningful imagery are closely related.

Odbert, Karwoski, and Eckerson (1942) examined synesthesia from a different angle: they looked at the relation between the mood of the music, and the colors suggested by the music. They asked subjects to report the mood of ten musical selections, and upon hearing the selections again report what color they associated with each. They found there was some similarity of color suggested by each selection of music. Odbert, Karwoski, and Eckerson found those individuals who disagreed on the mood of the selection tended to report different colors for the selection.

Other researchers have attempted to examine synesthesia from a different perspective; Omwake (1940) investigated color-music associations across different grade levels. She asked children 4-12 to indicate what color a certain piece of music made them think of. In three of the four examples presented she reported a consistency of response that appeared to strengthen with age.

Further studies on the subject of synesthesia were performed by Karwoski, Odbert, and Osgood (1942) in which they asked subjects who reported having

Synesthesia

7

synesthetic experiences to draw a picture to a particular selection of music. Karwoski, Odbert, and Osgood were the first to recognize that synesthesia may be common to ordinary subjects not reporting to be synesthetic. They found that there were similarities among the drawings made by the individuals claiming to have synesthetic experiences. Of more interest is that they also asked individuals who did not report having synesthetic experiences to draw a picture as a response to the music and found similarities between the drawings of both the "synesthetic" and "non-synesthetic" individuals.

Karwoski, Odbert, and Osgood suggest that synesthesia is the cognitive relating between two sensory experiences. They approach synesthesia from a general definition, as the association of sensory and imaginal experience on a cognitive level. Karwoski, Odbert, and Osgood state that the disputes concerning the origins of synesthesia are the result of a narrow definition of the subject. These researchers feel that the old definition of synesthesia is too rigid because it does not allow for the irregularity found when examining the sensory system in the context of this phenomenon.

Synesthesia

8

They propose that regularity is often only found under restricted conditions. Some of their ~~subject~~ reported the same experience when presented with the same tone twice but when this tone was incorporated into a musical composition they did not report the same experience. Karwoski, Odbert, and Osgood propose that the use of a broader term would help concentrate on the relations between sensory experiences and the different levels of individual differences in the vividness of each person's sensory experiences.

They determined that correspondences commonly observed in synesthetics' experiences were the same correspondences made by non-synesthetics in matching studies. Such close agreement led Karwoski, Odbert, and Osgood to claim that correspondences of "synesthetics" and the correspondences of ordinary subjects were both rooted in basic perceptual mechanisms.

Contemporary theorists agree that a broader definition of synesthesia is needed. Melara and O'Brien (1987) conducted a study to test if synesthetic correspondences of ordinary subjects were perceptually based. Subjects were asked to perform a position

classification task and a pitch classification task. A dot and a tone were presented where each high and low dot position to be classified was paired with a high or low pitched tone. They found that synesthetically congruent stimuli were classified more quickly than incongruent stimuli. These findings are consistent in showing interaction between cross-sensory dimensions.

Marks (1975) examined synesthesia in search for "regular systematic intersensory connections" that would help explain this phenomenon. He asked synesthetic and non-synesthetic subjects to make associations between different shades of grey and a number of tones that varied in loudness and pitch. Marks found brighter shades of grey were linked to a higher pitch and loudness. He also found the higher the pitch of a sound the smaller and more angular the visual image it evoked. Bright sounds were characterized by a high pitch and loud, sharp onset and cessation. He postulated that both sensory experiences shared a common feature which was brightness.

Marks (1987) further studied the cross-modal similarity between auditory-visual interactions. Marks

believes that although some synesthetic experiences are rare, there is evidence that suggests that everyone holds cross-sensory modalities that allow for an enhanced perceptual experience. In his research he has found that similar cross-modal (auditory-visual) equivalences that emerge in synesthesia also emerge in cross-modality matching. Notable are equivalences between loudness and brightness (high loudness matching high brightness), between pitch and brightness (high pitch matching high brightness), and high pitch matching small size. He too found reaction time for matching congruent stimuli was much quicker than incongruent stimuli.

Previous research has used short musical excerpts or tones to examine the synesthetic experience. Music is often very effective as a modifier of perception. Different qualities of music make it seem pleasant or unpleasant, exciting or tedious and can evoke various mood states.

Recent research in the field of music education supports the theory that people have color preferences that they associate with a particular selection of music (Cutietta & Haggerty, 1987). In a series of

Synesthesia

11

studies, Cutietta and Haggerty had 1259 individuals ranging in age from 18-78 listen to three selections of music. After the selection, the subjects were asked to indicate what color the music evoked. The results indicated that some selections of music were associated with a particular color in a large percentage of the cases.

Numerous other articles and studies have examined music's great power over individuals and its effect on a person's perception. Rosenfield's (1985, June) article describes music's great emotional power. She believes that music's emotional impact stems from past associations concerning particular musical styles. Listeners judge the mood of various short musical excerpts similarly and their judgement depends on specific elements in the music. People describe the mood of high pitched music as happy and playful, and low pitched music as sad and serious. Rosenfield (1985) found rhythm also arouses a range of feelings from tense to excited, through pronounced inconsistent rhythms. Rosenfield (1985) states that both tempo and pitch affect emotional reactions.

Vaughan (1990) also writes about the power of music. He states that musical performance without meaning will move an individual much more than straight music without inflection. Certain pulses in music strike the body directly against the natural pulse of the heartbeat. Natural energy is abruptly disturbed and the subject may become aggressive (Vaughan,1990). Yet, used the opposite way, the physical effect of certain music on the body can be therapeutic.

Music can have a great impact on the listener creating physical thrills through the vibrations pressing on various parts of the body. Goldstein (1980) examined what gives people "thrills" which are feelings that occur when people experience sudden changes in emotion. Goldstein (1980) described a typical thrill as a slight shudder, chill, or tingling sensation, usually localized at the back of the neck, and fleeting. Through a questionnaire survey he found that the most frequent thrills that occurred were with music. Subjects in his study were asked to listen to music of their own choice through earphones and raise one finger when they experienced a definite thrill, two fingers when they experienced a

stronger thrill, and three fingers indicated a maximum intensity thrill spreading to distant parts of the body.

In conclusion, most of the research on auditory-visual synesthesia has been observational or subjective in nature. Past investigations have used music stimuli and asked for introspective reports. It is essential that future research in this area use an alternative method other than self reports in order to provide for a more factual, and concrete basis of the synesthetic phenomenon.

Contemporary theorists tend to the general agreement that synesthetic correspondences reflect a connection among attributes from different sensory modalities. The research in this area suggests that synesthesia is not a product of perception from one sense but is rather an interaction among the senses. A new definition of synesthesia is needed to incorporate the idea of synesthesia as a joining of the senses and must be used to determine if synesthesia is in fact perceptually based in the general population.

It would also prove interesting to use other stimuli when testing synesthesia. One may use pictures as the visual stimulus as opposed to dots on a screen, and whole

Synesthesia

14

musical selections rather than tones or short excerpts of music. These stimuli may prove beneficial to the study of synesthesia as they better approximate the types of stimuli found in the real world.

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Abstract

Synesthesia is defined as the simultaneous response to a stimulus in more than one sensory mode when sensations belonging to one sense attach to sensations of another sense and appear regularly whenever a stimulus of the latter type occurs (Karwoski, & Odbert, 1938). Some contemporary theorists believe this definition of synesthesia is too rigid (Melara & O'Brien, 1987, Marks, 1987). Previous research in this area has been observational or subjective in nature. In the current study 72 subjects rated pictures on a 5-point scale (soothing to harsh) while being exposed to "soothing" or "harsh" music in a repeated measures design. It was predicted that the music would have an effect on perception of the pictures, with pictures perceived as soothing or harsh depending on the music presented. The findings demonstrate a significant interaction between picture perception and the music presented.

The Effects of Music Type on
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One may experience sensory blending in which sound produces not only sight but also taste. This blending of the senses is called synesthesia. An early definition of synesthesia describes it as " a phenomenon characterizing the experiences of individuals, in which sensations belonging to one sense attach to certain sensations of another group and appear regularly whenever a stimulus of the latter type occurs", (Karwoski, and Odbert, 1938). Contemporary theorists believe this definition of synesthesia is too rigid. A broader definition includes phenomenon like the joining of the senses, meaning that synesthesia reflects a presumed connection among attributes from different sensory modalities (Melara & O'Brien, 1987, Marks, 1987).

There are many types of synesthesia since any or all of the five senses may be simultaneously involved. The most common varieties are visual images aroused by sounds (Colored-hearing) and visual images produced by taste.

In a study performed by Marks (1985), he found that

subjects claiming to be synesthetic experienced the phenomenon where sounds aroused visual images whose color, brightness, and shape all varied with the pitch, loudness, and tempo of the acoustic stimuli. Marks (1935) proposed that although synesthetic experiences of these sorts are rare, synesthesia may be more common in the general population than previously thought. Marks (1987) suggests that there may be the existence of a more universal cross-sensory undercurrent running through the perceptual experience of the non-synesthetic as well as the synesthetic perceivers.

Melara and O'Brien (1987) agree that the synesthetic phenomenon is not solely an experience of few people. They view synesthesia as a connection between the senses based on shared figurative cross-modal properties. They believe that the intrusion of internal phenomenal sense information upon external attended information creates an experience similar to the perceptual experience.

Previous colored-hearing research has used short musical excerpts and tones to examine the synesthetic experience. Music communicates meaning which in some way

refers to the extramusical world of concepts, moods, and emotional states. Music may exert great emotional power over individuals (Rosenfield, 1985). Music has been used in the cinema and advertisements over the years to modify the reactions individuals have towards them (Huron, 1989). For example, music is used to heighten the individual's reaction to a frightening scene in a movie thereby enhancing the perceptual experience of fear. The use of music in these areas suggests a link between music as a modifier of experience and the phenomenon of synesthesia.

A number of researchers have studied the phenomenon of synesthesia. Research in synesthesia has been observational or subjective in nature. Past investigations have used music stimuli and asked for introspective reports. Some of the earliest studies of synesthesia were performed by Karwoski & Odbert (1938) when they asked introductory psychology students to report in detail the nature and type of color response they experienced when they listened to a particular selection of music. Further studies performed by Karwoski, Odbert, and Osgood (1942) asked subjects to draw a

Synesthesia

6

picture that best suited that particular selection of music. Odbert, Karwoski, and Eckerson (1942) examined the relationship between the mood of the music and the colors suggested by the music. Other studies of synesthesia performed by Cutietta,^{and} Haggerty (1987), and Omwake (1940) examined the color preferences people have associated with music.

They found that some subjects reported their visual response to music was similiar to a film or cloud, while others described their color response as "spreading sheets of color overlaying one another", (Karwoski, & Odbert, 1938). Others described their response to music as a band of color varying in width, degree of color, and movement depending on the piece of music played.

Further studies on synesthesia have found that the tempo and pitch of a sound affect several different aspects of the image. The higher the pitch of a sound, the smaller, more angular the visual image it evokes. A spritely melody played on a piccolo or violin tends to conjure up bright, sharp edged, and small visual images. The brightest visual images are produced by loud, high pitched sounds. Bright sounds are characterized by a

high pitch, and loud sharp onset and cessation (Marks, 1975, 1987).

Of particular importance are the results found by Karwoski, Odbert, & Osgood, (1942) that suggest the phenomenon of synesthesia may be more common to ordinary subjects not reporting to be synesthetic. When they instructed subjects claiming to be "synesthetic" and those not claiming to be "synesthetic" to draw their response to a selection of music they found that the drawings of both groups were similiar.

Most of the research on auditory-visual synesthesia has been observational or subjective in nature. Past investigations into synesthesia have used short musical excerpts or tone stimuli and asked for introspective reports. It is essential that further research in this area use an alternative means of evaluating synesthesia to provide for a more factual basis for the phenomenon of synesthesia. It would prove interesting to use stimuli other than dots or figures for the visual stimulus and tones for the auditory stimulus when testing synesthesia.

Contemporary theorists indicate that synesthesia may be a phenomenon that is more common to the general population than previously thought. It may be advantageous to determine if synesthesia in this population is perceptually based.

The purpose of this present study is to examine the synesthetic experience using a different report other than color, and use a rating scale to provide for a concrete basis of synesthesia. This was attempted by examining the effect of music on the judgement of the perceived "soothingness" or "harshness" of a picture. I propose that the introduction of music will vary the perception and the judgement subjects have for the pictures, dependent on the music stimulus presented.

Method

Subjects

A total of 72 introductory psychology students enrolled at Algoma University voluntarily participated in the study. The subjects were divided into three groups.

Apparatus

A total of 100 pictures were selected according

to shape, contour, depth, and contrast features. Each picture was transferred onto black and white negative slides so that they ^{could} ~~may~~ be shown to the subjects as a group, and the time interval for the presentation of the pictures controlled.

A panel of 8 judges randomly selected from the subject population were asked to rate for each picture on a 5-point scale, ranging from soothing to harsh. The mean for each picture was calculated and rank ordered. Pictures with the lowest means were placed into the soothing category, those with the highest means were put into the harsh category, and pictures with means falling between were placed into the neutral category. A total of 90 pictures were selected and divided into 3 sets of pictures with each set containing an equal amount of soothing, neutral, and harsh pictures.

Ten selections of classical music were chosen to be analyzed by the same panel of 8 judges. The panel was asked to listen to each piece of music and rate them on the 5-point soothing to harsh scale.

The mean for each selection was calculated and rank ordered. Bartok's String Quartet #2 was the musical selection yielding the highest mean and was chosen as the "harsh" music variable. The Orchestral Suite #3 by Bach was selected as the "soothing" music variable.

Procedure

The three treatments of the experiment were presented in counter balanced order as shown in Figure 1.

Insert Figure 1 about here

A within-subjects design was used to reduce the amount of variability in the rating of the pictures by subjects. A new set of pictures were used for each of the three treatment groups.

In the "pictures only" treatment, subjects were asked to view each of the 30 pictures for 16 seconds and rate them on a 5-point scale ranging from soothing to harsh.

In the "soothing" treatment, subjects were instructed to view each of the pictures while listening

to soothing music and rate them on the 5-point scale.

The "harsh" treatment group was similiar to the "soothing" treatment, the only difference being the introduction of the harsh music. In addition to rating the pictures on the 5-point scale, all subjects were asked to answer two distractor questions.

Results

A repeated-measures analysis of variance was performed on the data and revealed two significant main effects. The results of the experiment revealed differences in pictures rated as soothing, neutral, and harsh within each picture set, $F(2,68) = 144.57, p < .001$. Subjects rated soothing pictures as more soothing than harsh pictures.

The second significant difference was variation in the rating of pictures with the two types of music presented, $F(2,70) = 5.10, p < .001$. All pictures were rated as more harsh when subjects rated them while listening to harsh music. The results showed an increase in the mean rating of pictures judged as harsh and a decrease in perceived soothingness of pictures when the "harsh" music was introduced. Figure 2 shows these results.

Insert Figure 2 about here

Interactive effects were found in examining the difference in ratings of pictures and the type of music presented, $F(4,68) = 4.37, p < .001$. When the "soothing" music was introduced the results showed an increase in the number of pictures perceived as soothing. When subjects rated pictures while listening to soothing music, only neutral pictures were rated as more soothing.

The counter balanced order of presentation of pictures and music had no significant effect on how the pictures were rated, $F(2,69) = 1.99, p > .001$.

Discussion

Subjects who viewed the pictures without the presentation of music perceived the pictures through visual stimulus alone, while those listening to music while rating pictures experienced two sensory stimuli working together. The results found indicate support for my hypothesis which stated that music enhances and alters perception of the visual stimuli thus making it

appear to be more soothing or harsh.

The results of this study reveal one sense modified the perception of the other, the essence of synesthesia. These results substantiate the theory by Marks(1987) that synesthesia is more common in ordinary subjects than previously thought. Everyone holds cross-sensory modalities that allow for an enhanced perceptual experience.

This study also facilitates⁷ the need for a broader definition of synesthesia as proposed by some contemporary theorists (Melara & O'Brien 1987, Marks, 1987). Rather than synesthesia being defined as a product of perception from one sense, it would best be defined as a simultaneous interaction or joining of the senses. This definition would view the phenomenon of synesthesia as a connection among attributes from different sense modalities that unite a common perceptual experience. Subjects in this study indicated an enhanced perception for sensory attributes that shared a high degree of correspondence like soothing music and soothing pictures, and harsh music corresponding to a greater perception of harshness in the pictures rated.

Future research in this area should examine the

cross-modal link between sensory attributes by incorporating into their research other variables such as taste and tactile stimulation. It may also be beneficial to establish if in fact there is a specific neurological mechanism in the human nervous system that connects the senses to one another.

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Omwake, L. (1940). Visual responses to auditory stimuli.

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Rosenfield, A. (1985, June). Music the beautiful disturber.

Psychology Today, 48-56

Figure Captions

Figure 1 The counter balanced order of presentation for the three treatment groups.

Figure 2 Mean rating of pictures across the three treatment groups.

Figure 1

	Order of Presentation		
	picture set 1	picture set 2	picture set 3
group 1	pictures only	pictures soothing music	pictures harsh music
group 2	pictures soothing music	pictures harsh music	pictures only
group 3	pictures harsh music	pictures only	pictures soothing music

Figure 2

PICTURE RATING

