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Who am I?

Science Museum Live Science

Application form

July 20XX – June 20XX

EXAM

Research topic

What field does your research fall under (e.g. genetics, psychology, epidemiology, etc.)?

Psychology

Research details

Aims

What are you hoping to achieve with your research?

The research will consider the following question. What principles do synaesthetes who experience 'visual music' use to map between the auditory and visual domains, and are these principles judged as aesthetically pleasing to people who do not experience synaesthesia? The results will lead to important insights into how aesthetic judgments are related to cross-modal processes in the brain.

Sources of funding

How is your research being funded?

The project has received funding from a Wellcome Trust Sci-Art grant. All additional costs will be borne by the xxx Synaesthesia Research Group.

Rationale

Why are you carrying out your research? How does this fit in with the gallery theme of *Who am I?* specifically: what will visitors find out about themselves?

Art is created, perceived and appreciated by human brains. Therefore, many people believe that a scientific account of art, driven by research in the neurosciences, is a realistic goal (e.g. Zeki, 1999). One aspect of art, recently termed 'visual music' is concerned with how the visual arts can capture, and be inspired by, properties of music (e.g. its non-depicting nature) and also with how music and visual art can be directly combined (e.g. in *son-et-lumieres*). Brougher, Strick, Wiseman and Zilczer (2005) discuss in detail the origins of this approach since 1900, although earlier precedents exist (e.g. Scriabin's *Prometheus*, Castell's colour organ). More recently, science has become increasingly interested in how information from different senses is integrated in the brain (e.g. Driver & Spence, 2000). The study proposed below will be one of the first attempts to pull these two approaches together, using insights gained from individuals who experience a naturally occurring form of 'visual music', namely those with synaesthesia.

Individuals with synaesthesia have anomalous perceptual experiences in addition to those that most other people would experience. For example, some synaesthetes experience vision as well as sound when listening to music (Marks, 1975). Research has established that these experiences are real and reflect true differences within the brain (e.g. Nunn et al., 2002). Although differences exist, in other respects there are striking similarities between the consciously reported experiences of synaesthetes with associations generated by other members of the population who lack synaesthesia proper. For example, high pitch tones tend to be described as higher (in space), lighter in colour, smaller and less rounded than low pitch tones. As such people with synaesthesia may provide unique insights into how visual and sound qualities map on to each other more generally. As part of this project, we have already begun to collect verbal and visual descriptions of synaesthetic experiences from known synaesthetes. These will be reproduced as audio-visual animations and analysed in terms of statistical correlations between auditory and visual dimensions (e.g. correlations between pitch and size or lightness). The Live Science project will consider the implications of these correlations for our aesthetic appreciation of 'visual music'. Are correspondences conforming to synaesthetic principles judged as more aesthetically pleasing than those that do not? Does having vision and music together lead to greater liking per se (relative to vision and music in isolation)? To what extent this is due to synaesthesia proper (operating in the few), or due to synaesthesia-like correspondences that operate more generally? Is 'visual music' generated by synaesthetes preferred over that generated by non-synaesthetes?

References

- Brougher, K., Strick, J., Wiseman, A., & Zilczer, J. (2005). *Visual Music: Synaesthesia in Art and Music Since 1900*. London: Thames & Hudson.
- Driver, J., & Spence, C. (2000). Multisensory perception: Beyond modularity and convergence. *Current Biology*, 10, R731-R735.
- Marks, L. E. (1975). On coloured-hearing synaesthesia: Cross-modal translations of sensory dimensions. *Psychological Bulletin*, 82, 303-331.
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- Ward, J., Huckstep, B., & Tsakanikos, E. (2006). Sound-colour synaesthesia: To what extent does it use cross-modal mechanisms common to us all? *Cortex*, 42, 264-280.
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Chemicals/reagents

Do you propose to use any chemicals or reagents? If so, what would you be using?

No chemicals or reagents will be used.

Methods

How do you propose to carry out your research in the Live Science space?

Participants. Visitors to the Science Museum will be invited to take part in an experiment on ‘Could you be an art critic?’. The experiment is suitable for almost anyone to take part in. We are particularly interested in recruiting adult participants although we would welcome the opportunity to test younger people. The data from under 18s would be analysed separately and would constitute exploratory research. The experiment is ‘culturally fair’ and does not place strong demands on English language proficiency. However, participants must have sufficient English to understand the instructions and give consent.

Part 1: Liking Judgments

Materials. A set of 20 animated audiovisual movies will be obtained from the reports of 5 music-colour synaesthetes, generating a total of 100 movies. These could consist of a short sequence of 3 to 4 notes. These would be generated prior to the present experiment. This basic set of movies will then be distorted or played in one of six conditions:

- 1) Sound only
- 2) Visual only
- 3) synaesthetic (i.e. sound + vision, as generated by the synaesthetes)
- 4) unsynaesthetic/ negatives (negative image of [3], i.e. colour & brightness inverted)
- 5) unsynaesthetic/ upside-down (same as [3], but spatial position and shape inverted)
- 6) unsynaesthetic/ random (random pairings of [1] and [2])

This generates a set of 600 stimuli. Each participant will be asked to rate a selection of 60 of the stimuli, 10 from each condition (based on the same sounds and visions, although not necessarily generated by the same synaesthete). If 150 people are tested in total then each stimulus will have been rated 15 times by 15 different people in each condition.

Procedure. The 60 animations for each person will be presented in a random order. Participants will be asked how much they like the movie, considering both the sound and vision (when both are present). The instructions will stress that there is no right or wrong answer. Liking judgments will be made by moving a pointer along a line in which points on the line are marked with ‘smiley’ faces (ranging from very smiley to very unsmiley with neutral in between). The pointer can be dragged by a mouse.

Analysis. A one-way ANOVA will establish whether or not there are differences in liking between the 6 conditions, and Student-Neuman-Keuls test will be used to verify where such differences lie. Separate ANOVAs will be conducted by participant (N=150), by item (N=100) and by synaesthete (N=5).

Participants will see an animated image and will hear a simultaneous sound. They must judge how much they like/dislike it by dragging the triangle with the mouse.

Are certain sound-vision combinations more aesthetically pleasing?

Can this be related to underlying neuro-scientific principles?

Part 2: Preference Judgments

In this task, forced-choice preference judgments are used rather than liking judgments. A sound is always displayed and is accompanied by two visual movies – one based on a description provided by a synaesthete and one based on a control description. The sounds consist of individual tones. Participants are merely asked which of the two visual images goes best with the sound.

Participants. Non-synaesthetic participants will be recruited via the Live Science initiative at London's Science Museum. All participants will be over 18 years of age and will give informed consent. Participants must be proficient in English so that they understand the instructions but need not be native English speakers. It is anticipated that 75 people will be tested (see below). If time permits, the present study can be replicated in a further sample of 75 participants using sequences of sounds and visual displays rather than single sounds. Synaesthetes tend to choose colours and shapes from a limited range, whereas controls tend to sample more widely. This may give 'true' synaesthesia a greater sense of coherence that is lacking in the animations derived from controls, and this may be judged as aesthetically more pleasing.

Materials. Twenty sound-vision pairings from 5 synaesthetes are to be contrasted with 20 sound-vision pairings from 5 controls. These materials will be prepared in advance. Single tones will be used. This results in 500 permutations (i.e. $5 \times 5 \times 20$). Each participant will be asked about 100 of these. If 75 people are tested, then each permutation will have been judged 15 times by 15 different people.

Procedure. The sound will be played and two animations displayed side-by-side. One animation would have been obtained from a synaesthete for that sound and one from a control. The synaesthetic animation will appear on the left and right equally often. The participant's task is to decide which of the two animations they prefer. This can be indicated by a mouse click to that side of the screen.

Analysis. The experimental hypothesis is that participants will prefer the animations generated by synaesthetes. This can be tested with a one-sample t-test based on a 50:50 distribution of preferences expected by chance.

Participants will see two animated images and will hear a simultaneous sound. Only one will have been generated by a synaesthete. Participants must click on the one they prefer. Are the 'visual music' experiences of synaesthetes preferred over those generated by other members of the population?

How volunteers will be involved in research

How long would each volunteer be required for? What would he/she be required to do?

The volunteer will take part in a simple test of deciding how much they like an animation, or in deciding which of two animations they prefer. At the end of the test, they will have the opportunity to find out about the how such judgments are made and learn about the fascinating condition of synaesthesia and to discuss the study with active research scientists in the field. Are aesthetic judgements in the 'eye of the beholder' or are more systematic principles at play?

How visitors will be informed of results

Once the results have been analysed, how would you inform your volunteers of their contribution to your work?

The volunteers can take away an information sheet that tells them about the experiment and about synaesthesia. The sheet will contain contact details of the research group as well as useful web resources if they wish to discover more. An example of the sheet is attached.

The visitor may leave his/her email address to receive notification of the results of the study when it becomes available (hopefully within 3 months of completion). Our research group also has a website that contains a summary of our ongoing work. In addition, we plan to disseminate our results in both a leading scientific journal and the popular press.

Proposed dates of research and timings

When would you propose to start your research and how much data would you be hoping to gather?

We hope to test up to 300 people in total, although the data could be analysed with 200 participants and this is the minimum number required. It is our aim to test over a 3 week period, for three days of the week (one day per week will be a Saturday). We aim to begin testing in mid-late April which may also coincide with school holidays.

Equipment

Research equipment

What equipment will you be bringing to conduct your research?

The researchers may need to bring in a portable computer, and will require the use of a desk (6 foot long) and three chairs. The computer will be PAT tested beforehand. No storage requirements are envisaged.

Museum equipment

What Museum equipment do you propose to use?

Two desktop PC's with monitors are required from the museum for the duration of the study.

Volunteers

How the Museum population is relevant to the research

Please outline why you wish to use the Museum population in your research.

The study relies on obtaining information from a broad section of the population – different ages, different backgrounds and different sexes. It would be impossible for us to achieve this sampling from the University population and very time consuming to achieve it in other ways. The Science Museum will enable us to achieve this goal very quickly and will give the general public an opportunity to learn more about our research.

How schools will be involved

The Science Museum will be able to liaise with visiting school groups to obtain parental consent on behalf of those under 18, should you wish to include this group in your research.

We are keen to have schools involved in the project. We can test only up to three children at a time. We would be willing to give short informal presentations to school groups who are interested in learning about synaesthesia or about how the brain appreciates art.

Legal

Ethical approval

Please state whether ethical approval has been gained for the project, or when it is likely to be obtained.

Ethical approval will be obtained from University College London before the study commences. The committee will be informed of the intention to collect data in the Science Museum.

Information sheets and consent forms

Please include copies of the information sheets and consent forms you propose to use.

Copies of volunteer information sheets and informed consent forms are attached to this document.

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