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Ethical considerations for psychophysiology studies

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All psychology research should strictly adhere to ethical principles outlined by the researcher's local governing body. In the UK, this is the British Psychological Society (BPS). However, in papers advising on methodology used in psychophysiology (a research area within psychology), issues linked to ethics are rarely mentioned despite the invasive nature of this type of research. Guidelines published by local governing bodies are never mentioned. In this paper, important ethical issues in psychophysiology research are discussed with respect to BPS guidelines. Recommendations are made for ensuring ethical practice when conducting psychophysiology research. This paper is intended for those new to psychophysiology research (postgraduate and undergraduate students) and should be read in conjunction with the BPS 'Code of ethics and conduct'.

Introduction

By their nature, psychophysiology studies tend to be more physically invasive to the participant than more typical psychology type studies. Usually participants perform some task or other while their involuntary bodily reactions are monitored. These bodily reactions are monitored via electrodes that are attached to the participant's body. For example, in some studies electroencephalogram (EEG) or brain wave recordings are monitored via electrodes placed against the surface of the scalp. In other studies heart rate (HR) is monitored, usually through electrodes placed against the skin on the chest. It is connecting the electrodes to the participant's skin that increases the invasive element of these types of studies. In addition to having electrodes connected to the skin, it is often necessary to improve the connection by applying electrode gel at the body surface/electrode connective junction. The gel itself is anti-allergenic and therefore the risk of allergic reaction is reduced but there can be a large gel residue left over after the electrodes are removed (particularly with EEG research), something that may be distressing to some participants.

From this brief and very general description of the typical experimental procedure during a psychophysiology study, it is clear that ethical issues need to be carefully considered. However, practical advice on the conduct of psychophysiology research in an ethical manner is rare. For instance, in a series of methodology papers which are available on the website of the Society for Psychophysiological Research (SPR) [1-10] the issue of ethics is rarely addressed. Several papers make no mention of ethics [1-4]. These tend to focus completely on the technicalities and analysis protocols of the physiological methods which they are covering. Others focus on guidelines for publication associated with the physiological methodology which serves as the researcher's chosen dependent variable [5, 6]. Again, no instruction on ethical practice when carrying out psychophysiology studies is offered. Two papers focus on very specific issues which have an obvious bearing on ethical practice when carrying out psychophysiology research [7, 8]. The first advises on working with children and certain clinical groups; the second on measures which should be taken to reduce the risk of disease transmission in the psychophysiology laboratory. However, more general aspects of ethical practice in psychophysiology studies receive no comment. One paper written by a team of leading electrophysiology researchers offers excellent guidelines on the practicalities surrounding brain wave research (from the design of studies right through to producing the finished report) [9]; however ethical issues are confined to a short section advising the gaining of informed consent and a referral to a paper described earlier [8].

The best coverage of more general ethical issues is offered by a paper providing guidelines for electromyographic research [10]. This paper includes advice on the treatment of the participant prior to and during the study, how the room is furnished, and the type of language to use in describing the study and procedures to participants. However, the guidelines are presented in a paper which is specific to one particular area in psychophysiology research. Hence, it is only likely to be considered by researchers who record that particular physiological dependent variable.

British Psychological Society (BPS) guidelines and their implications for psychophysiology

The BPS has produced a document entitled Code of ethics and conduct [11]. This contains information about general issues of good practice when performing psychological research. All psychology researchers in the UK are expected to adhere to these principles. Psychology societies and associations in countries other than the UK have produced similar guidelines. For instance, the American Psychological Association (APA) has produced a document entitled Ethical principles of psychologists and code of conduct [12].

All of the points raised in the BPS guidelines are as applicable to psychophysiology studies as they are to any other type of psychology study. However, none of the articles [1-10] referred above make any reference to the BPS guidelines (or any other association's guidelines). In the following section, considerations raised by the BPS guidelines that have specific significance for psychophysiology experiments will be highlighted and discussed. It is intended that the remainder of this document act as an annex to the BPS guidelines rather than a replacement so it is strongly recommended that psychophysiology researchers consider the remainder of this document in conjunction with the BPS guidelines.

Informed consent

Section 1.3 (p 12) of the BPS guidelines state that the researcher should seek informed consent and ensure that participants 'are given ample opportunity to understand the nature, purpose, and anticipated consequences of any (professional services or) research participation'. This part of the guidelines has specific significance for psychophysiology researchers. Researchers should leave no doubt in the minds of participants about exactly what is going to happen to them in preparation for, and during, the experiment. If they are going to have electrodes attached then they should be informed of the exact procedure that will be followed and be shown all of the equipment that will be used (eg electrodes, gel applicators etc). In addition researchers should make it clear how the effects of the preparation procedure may affect participants post-participation. For example, as mentioned above, following an EEG experiment, participants are nearly always left with a substantial amount of residual electrode gel in their hair that is likely to need immediate washing out. Researchers have an obligation to inform participants of these kinds of issues before seeking their informed consent. Suggested documents which can be used to help to ensure participants are fully informed prior to giving informed consent are shown in appendices A and B to this article.

Right to withdraw

After they are clear on procedures, participants should always be made aware that, although they have given their informed consent to participate, they are still free to withdraw from the experiment. In section 1.4ii (p 14) of the BPS guidelines it states that researchers (and practitioners) must 'ensure that from first contact clients are aware of their right to withdraw at any time from receipt of professional services or from research participation'. Unlike other psychology studies, the complex range of recordings which are made means that psychophysiology studies require a substantial investment of time in their setting up. This could result in some participants feeling a sense of guilt about withdrawing. For this reason, it should be emphasized (perhaps more strongly than in other types of psychology research) that if the participant feels uncomfortable about participation at any stage, she/he can withdraw his/her participation and not feel any sense of guilt.

Physical contact and researcher conduct

In section 3 of the BPS guidelines, it is repeatedly mentioned that the researcher has a responsibility to avoid harm coming to his/her participants. This is outlined in the Statement of Values and also in 3.1i (p 17). Whilst it is clear that participants should not be harmed in any way during studies (either mentally or physically), researchers should also refrain from causing them any kind of mental or physical discomfort during electrode placement. Obviously, electrode attachment will involve a degree of physical contact and the level of physical contact is something that the researcher has to think carefully about. As pointed out, discomfort can be physical or mental - each of these is discussed below.

The possibility of participant physical discomfort arising during electrode placement is an obvious problem and ethical issue. The researcher should make sure he/she is sufficiently skilled in electrode placement to keep the participant's physical discomfort to an absolute minimum. Participants should be urged to indicate whenever they feel any physical discomfort or pain and the researcher should modify his/her electrode application procedures accordingly. If the participant appears to be repeatedly suffering then it is probably wise to suspend the session, remove the electrodes from the participant, and seek further training in electrode application. It should be stressed to the participants that they will not be helping if they try to endure any physical discomfort during electrode attachment, as effective electrode attachment should not be causing physical discomfort. If physical discomfort is experienced it is possible that the electrodes may have been incorrectly attached.

Mental discomfort caused during electrode placement is less obvious than physical discomfort.

Electrode placements may involve the experimenter coming into contact with sensitive areas of the participant's body – the participant may not be comfortable with this. If the procedures and electrode placements are carefully explained to the participant before they give their informed consent they should have already considered this and given, or not given, their informed consent in accordance. However, as researchers, it is probably better to err on the side of caution, even when informed consent is given, and whenever possible get participants to attach electrodes themselves under supervision. Whilst supervising participants attaching the electrodes themselves is the least invasive way of attaching electrodes, the level of supervision given has also to be carefully considered. For example, a participant may not be comfortable with an opposite gender researcher carefully observing them attaching electrodes to their chest. This issue is difficult to address as obviously the participant needs to be supervised to ensure they get the electrode in the correct position. The best solution is probably to indicate to the participant where they need to attach the electrode and then avert gaze once they have to adjust clothing to attach it. Once they have readjusted their clothing so that it is now covering the electrode, the researcher will be able to get a reasonable idea (from protrusions in their clothing, their verbal description and the quality of the recording) as to whether the electrode is in the correct position. Obviously getting the participant to attach his/her electrodes is only possible when electrode placement does not take a great deal of skill (eg attaching electrodes to the skin on the chest for HR monitoring).

Reporting recording irregularities

Psychophysiology experiments involve monitoring physiological responses from a variety of the body's most important organs. For example, the heart's sequence in supplying blood to other parts of the body is measured when recording electrocardiagram (ECG). In a healthy person, physiological response will normally follow a fairly regular basic pattern and this will not vary much from one person to another. However, in some cases, there may be irregularities in a recording that the researcher may feel, for some reason or another, should be brought to the attention of the participant. Section 3.3viii (p 19) of the BPS guidelines states that researchers should 'inform research participants when evidence is obtained of a psychological or physical problem of which they are apparently unaware, if it appears that failure to do so may endanger present or future well-being'. It is difficult to know exactly how to deal with this issue because psychophysiology researchers are not qualified to make a medical judgement. However, in the course of psychophysiology investigations it is likely that researchers will be able to make an informed decision on whether a physiological recording is 'normal' or 'irregular'. As such, the researcher would have an obligation to explain their concerns to the participant.

It would probably be best if this issue were addressed at the informed consent stage so that it is something the participant will definitely have considered before taking part in the study. The informed consent form, or information sheet, could include a few sentences that would clarify this issue for the participant. A section on this could be something like the following:

> I understand that in a proportion of cases physiological recordings show certain irregularities. I also understand that it is department policy at the [the research institute's name] for participants to be advised by the researcher if their recording shows irregularity. If the researcher does highlight an irregularity with my recording, I understand that I should seek the advice of my GP. I am also aware that the researcher has no training in detecting health threatening physiological irregularities.

It should also always be emphasised that a psychophysiology researcher is not qualified to make any medical judgements and that their comments are merely based on informed opinion. Coupled with this, it should be explained to the participant that any opinions given by their GP or a clinician regarding the irregular recording, supersede the researcher's opinions.

Other issues

In the previous section, I have outlined issues from the BPS guidelines that have specific importance for psychophysiology. Certain other issues are also important that are not specifically mentioned in the guidelines but still fall within the remit of an ethical researcher.

Hygiene

It is important that research is conducted in a hygienic way. Specifically, this includes the wearing of latex gloves during contact with participants (though enquiry to ensure that the participant does not have a latex allergy needs be made), appropriate disposal of electrodes and gel applicators, and thorough cleaning of reusable electrodes and EEG electrode caps. Less obviously, this also includes the cleanliness of the laboratory and, if necessary, providing participants with materials for washing after they have participated (eg shampoo and a towel after participating in an EEG experiment). It is also good practice to try to help the participant by removing some of the residual electrode gel (cotton wool can be used to do this); for instance, this

might be done after following an EEG study. In some cases, the participant may feel happy that their hair is sufficiently clean after this, meaning they will not have to wash their hair. This will reduce the amount of time he or she spends in the study (see below).

In some cases, it has been reported that electrode application procedures have accidentally resulted in a skin abrasions or skin puncturing that have in turn led to bleeding. Any equipment that comes in to contact with blood should be immediately sterilized. Advice should be sought from the equipment manufacturer before any kind of sterilization is performed.

Time

As psychophysiology studies involve more complex recording equipment than the more typical psychology studies they have a tendency to be very time-consuming. It is important that participants are not inconvenienced through participating in a study for any longer than they need. Several simple steps can be performed before the participant's arrival to ensure that they are not going to be kept waiting around.

Before the participant arrives the researcher should always make sure they are fully conversant with the recording equipment. They should also test the equipment so they can find, and put right, any problems. In addition, they should arrange all of the equipment which is likely to be needed (eg gel applicators, electrodes, cleaning solutions, cotton wool, surgical tape etc) so that they are close at hand. If the researcher does these things prior to the participant's arrival, no more of their time will be occupied than is absolutely necessary.

It may also be sensible to write out a list of specific tasks that need to be carried out after the participant has arrived. This will cut down on the researcher's thinking time (and hence reduce the amount of the participant's time occupied) and will also have the added benefit of ensuring that all of participants are treated in exactly the same way.

Conclusion

In papers discussing practice, when recording physiological responses from participants in psychophysiology research, issues exploring how best to operate according to ethical principles laid down by local governing bodies (such as the BPS or the APA) are often overlooked. Given the intrusive nature of psychophysiology research (caused by the connecting of electrodes to the participant's body to record physiological response), this is an important omission. Papers have typically focused on providing information about best practice in the technicalities of physiological recordings. They have also typically advised on best practice for securing publication when physiological response has been recorded as part of the study. Some papers cover issues related to ethics but often focus on a very narrow ethical issue (such as disease transmission). Very little is mentioned about the wider ethical issues covered in governing bodies' guidelines.

In this paper, I have discussed ethical issues in psychophysiology from the perspective of the BPS Code of ethics and conduct [11]. The main issues covered relate to informed consent, participants' right to withdraw, physical contact between the researcher and participants, and the reporting (to participants) of irregularities evident in their physiological recording. A number of other issues are covered that, whilst not specifically mentioned by the BPS, have a clear place in any discussion about ethical practice when physiological response is recorded as part of a study. For each issue covered, ethical issues and problems are highlighted, and possible solutions are offered.

Overall, this paper is intended as a guide to researchers new to psychophysiology research. It should be read in conjunction with the BPS Code of ethics and conduct[11].

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Appendix A: Information for EEG participants

This document is intended to give you further information about participating in an EEG study before you choose to give or not to give your informed consent. The researcher conducting the study will go through this document with you and will show you the equipment that he/she will be using during the study. All that the EEG recording equipment can do is record the electrical activity that is generated by your brain. There is no way that you can receive any kind of electric shock from the equipment because it is set up in such a way that it cannot generate its own electrical signals.

During the setting up of the study you will:

- *Have your skin cleaned with surgical spirit* in preparation for face and earlobe electrode placement.
- *Have electrodes placed on the surface of your scalp, face and earlobes.* The scalp electrodes are woven into an electrode cap (similar to swimming cap) which you will be asked to wear on your head. In putting the cap on your head the electrodes will automatically self-locate. The face and earlobe electrodes (maximum of four face and two earlobe) are small metal discs (about 7 mm diameter) with a lead that connects back to the EEG recording equipment. These will be located by the researcher and held in place with surgical tape and are used to take recordings that act as a reference for the EEG recording and as a measure of face and head muscle movement.
- *Have electrode gel applied at the electrode/scalp or electrode/skin junction.* Once the cap has been put on correctly the researcher will use a gel applicator to apply gel to the space between the surface of the electrode and your scalp (or skin in the case of face and earlobe electrodes). The part of the gel applicator that comes into contact with the your body's surface is brand new for each participant so there is no risk of cross-infection.
- *Experience a gentle scratching sensation when the researcher is parting your hair and applying the electrode gel.* You will be able to feel this, but it should not be uncomfortable. If it is uncomfortable you should tell the researcher immediately.

After the study you:

- *Will have all the electrodes removed for you by the researcher but you will find that you have some residual electrode gel in your hair that is likely to need washing out.* The researcher will remove as much as possible of the residual electrode gel as he/she is removing the cap and will then offer you a clean towel, shampoo and the opportunity to go and wash your hair in the shower on floor 1.
- *May find that you have three temporary small red marks on your forehead* caused by the pressure of the frontal electrodes. These marks usually go down in 20-40 minutes. If you find that these marks do not go down you should seek the advice of your GP.

Miscellaneous information

- *All gels and cleaning solutions that will be used are anti-allergenic and as such have a greatly reduced chance of causing allergic reactions.* Please inform the researcher if you have ever experienced any reactions while using anti-allergenic skin products. If you have, you need to think carefully about whether you want to participate. If you participate and find that you do display some kind of a reaction, you should seek the advice of your GP. Information about the solutions that have been used during your participation is available from the researcher.
- The EEG cap is washed thoroughly in boiling water and an anti-allergenic cleaning solution after each participant. Also, in the very unlikely event of the cap coming into contact with blood the cap is additionally sterilised in a cold soak solution.

Appendix B: Information for participants in psychophysiology studies involving respiration and/or cardiac and/or electrodermal recording

This document is intended to give you further information about participating in psychophysiology studies where respiratory, cardiac or electrodermal activity is being monitored. It should be read before you choose to give or not to give your informed consent. You only need to read the sections that are relevant to the study that you are participating in. The researcher will go through this document with you, pointing out the relevant sections and will also show you the equipment that he/she will be using during the study. All that the recording equipment can do is record the electrical activity that you generate. There is no way that you can receive any kind of electric shock from the equipment because it is set up in such a way that it cannot generate its own electrical signals.

Electrodermal activity

During the setting up of an electrodermal activity (EDA) study you will:

- *Have your skin cleaned with surgical spirit* in preparation for electrode placement.
- *Have electrodes placed on the surface of the skin on one of your hands* (maximum of two electrodes). This will be a totally painless experience. The electrodes are small metal discs (about 7 mm diameter) with a lead that connects back to the electrodermal activity recording equipment. These will be located by the researcher and held in place with surgical tape.
- *Have electrode gel applied at the electrode/skin surface junction.* When the researcher is placing the electrodes to the surface of your hand he/she will also apply some electrode gel to the surface of your skin to make a better contact between the electrode and the skin's surface. A special anti-allergenic gel is used.

After the EDA study you:

- *Simply have the electrodes removed and have the residual gel cleaned off of your hand by the researcher.*

Cardiac activity

During the setting up of a study involving cardiac monitoring you will:

- *Attach adhesive electrodes to yourself.* Usually one electrode is attached to the skin just above your breastbone and one to the skin on your left ankle (though this can vary). The researcher will supervise this in order that you attach the electrodes correctly. These electrodes will be connected to the relevant piece of recording equipment.

After the study involving cardiac monitoring you will:

- Simply remove the electrodes that you attached during the setting up stage and discard in a waste paper basket.

Respiration

During the setting up of a study where respiration is monitored you will:

- *Have a strain gauge attached loosely around your chest* to measure your chest expansion and contraction as you breathe. The strain gauge is like a large flexible belt and will be passed all the way around your upper body (around your chest, passing under each of your arms). The output from the strain gauge will then be connected to the relevant piece of recording equipment. This should not cause discomfort in any way and if you feel uncomfortable at any time alert the researcher immediately.

After the study you will:

- Simply have the strain gauge unfastened and removed by the researcher.

Miscellaneous information

- *All gels and cleaning solutions that will be used are anti-allergenic and as such have a greatly reduced chance of causing allergic reactions.* Please inform the researcher if you have ever experienced any reactions while using anti-allergenic skin products. If you have, you need to think carefully about whether you want to participate. If you participate and find that you do display some kind of a reaction you should seek the advice of your GP. Information about the solutions that have been used during your participation is available from the researcher.
- *Brand new adhesive electrodes are used for each and every participant* in cardiac recording studies, and electrodes used in electrodermal activity studies are washed thoroughly after each use.