Web-based versus Lab-based Studies:
A Response to Kendall (2008)

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ABSTRACT: While in an earlier commentary (Honing & Ladinig, 2008) we stressed the potential of Web-delivered experiments for music perception research, the ongoing discussion on Web-based versus lab-based studies seems to circle around issues of method and control (Mehler, 1999; Kendall, 2008). We agree with the importance of these issues from a methodological point of view. However, we continue to stress that these issues are not essentially different for Web-based as compared to lab-based studies.

IN Honing and Ladinig (2008) we stressed the potential of Web-delivered experiments for music perception research. This to compliment the often critical viewpoint of methodologists that are concerned with fundamental issues of method and control in empirical and experimental research, Kendall (2008)—in a commentary to Honing and Ladinig (2008)—being no exception. Hence, in this response, we will directly address issues of method and control, while putting them in a slightly wider perspective than was done in Kendall's commentary. Our main claim is that, with respect to issues related to human subject protocols, Web-based studies are not essentially different from lab-based studies.[1] Furthermore, we restate that Web-based studies have great potential for music perception and cognition research, especially in domains where versatility and ecological validity is at stake.

The main criticisms brought forward in Kendall (2008) are issues of a methodological and ethical nature related to 'human subjects protocol.' We share some of these concerns.[2] In this response, we will explain why some of Kendall's methodological concerns are not justified and others can simply be mastered (with proper experimental design). Finally, we will revisit the ethical issues that were raised, grouped by three basic principles of human subject research.

METHODOLOGY: PROPER DESIGN

First of all, we entirely agree with Kendall's suggestion that "the experiment design must be at the service of the questions and hypotheses." However, we do not see how committing to this *proper design principle* impedes on using the Internet's great and numerous benefits for doing research. On the contrary, proper experiment design in Internet-based experimenting has been much advocated as crucial in optimizing the benefits and avoiding some problems in this type of research (e.g., Birnbaum, 2007; Birnbaum & Reips, 2005; Reips, 2000, 2002a, 2002b, 2007). That some experiments cannot be conducted on the Internet, for principal or practical reasons—or because of a researchers' preference not to try a new methodological approach—does not imply that experiments on the Internet should be avoided altogether.

As for ecological validity, following the *proper design principle* that we and Kendall agree on, this depends on the specific question the research was designed to answer. If the research aims at high control of many parameters, then a carefully set up laboratory environment with calibrated equipment is the best choice. But if one is looking for generalizability to real-world settings, then a Web-based experiment with a between-subjects design and random allocation of participants to conditions will often be better, as it

taps into a multitude of user-generated settings with a realistic variance in many parameters (for an illustrative example of this principle see Laugwitz, 2001, on color perception in software ergonomics). The former strategy may often be more adequately suited for basic theory-guided research, while the latter may be the better choice in applied research. Nevertheless, Internet-based research has been used to solve important issues in basic research (e.g., Birnbaum, 2001; Fontaine et al., 2007; Honing, 2006; Klauer, Musch, & Naumer, 2000).

METHODOLOGY: RELIABILITY AND VALIDITY

Reliability is a necessary prerequisite of validity, because we can only determine the relationship between the *explanandum* and the *explanans*, if we can measure them. Thus, a statement like "However, reliability is the counterpoint to validity. As validity in this context may potentially increase, reliability can decrease" (Kendall, 2008, p. 8) is nonsensical. Of course, with respect to reliability both lab and Web approaches are demanding. Web-delivered experiments have limited control over the home environment (e.g., variables like a flat response of a loudspeaker cannot be determined online), while internal validity is often crucial in psychophysical experiments. On the other hand, while, for example, humidity and temperature of the air can influence the room acoustics, these might not always be considered essential in music perception experiments, and a finding might be confined to the unique combination of parameters present at the time of and with the equipment used in a lab study. Note that the variance of parameters is working against us when choosing the Internet as the setting for our research: if an effect is detected, this is *despite of* all kinds of real-world variance and technological equipments.

METHODOLOGY: SAMPLING

In his concluding paragraph, Kendall builds a pseudo-argument against Internet-based research: he describes it as more difficult to acquire homogeneous samples on the Internet on the grounds that many of the most visible Web experiments are visible because of an open call to the Internet.[3] However, the opposite is the case: The Internet provides many more options to target very specific samples that may be very difficult or impossible to recruit offline. For example, Mangan and Reips (2007) report two Web studies with people suffering from the rare disorder of sexsomnia. Two Web studies reached more than five times as many participants from the target group than all previously published offline studies from more than 20 years of (often case study) research combined. Furthermore, by using the *multiple site entry technique* (e.g., Reips, 2007) several different samples can easily be recruited via the Internet to compare their data.

INFORMED CONSENT

We do not think this issue is essentially different for Web-based as compared to lab-based studies. There is no technical reason why one could not obtain informed consent from participants over the Internet in a reliable way. Actually, stressing this as the main problem of Web-based studies is quite naïve. First, much research that can be delivered via the Web is not invasive and thus exempt from excessive procedures of securing ethical conduct (much other Web content is more dangerous). Second, most Web-based studies simply start with a request to give one's consent, along with a description of the task, and information on any potential risks. In addition, in Web-based experiments participants have the freedom to drop out whenever they like, where they might feel more pressure to continue in a lab-based version of the same experiment (Birnbaum & Reips, 2005; Reips, 2000).

PRIVACY AND CONFIDENTIALITY

Another criticism raised in Kendall (2008) is about privacy. Kendall suggests lab-based computer data to be safer than those collected via the Internet (p. 9). This again is a naïve idea. Privacy and confidentiality are as much an issue for lab-based studies as Web-based. In fact, one could even argue that because of the accessibility of Web-based experiments this issue is taken more seriously by experimenters using the Internet.

More interesting is Kendall's position that "A query of the soundcard specifications and browser elements could be considered data collection and potential invasion of privacy" (p. 9) . However, we don't see why information sent to a Web study (via default or user-specified settings in browsers) would meet that description, particularly if a participant consented explicitly or implicitly to such aspects of participation.

RELIABILITY AND FRAUD

One can argue that the potential of fraud rises proportionally with the number of participants. Also the absence of personal interaction in Web-delivered experiments might be a potential source of fraud. However, as mentioned in Honing and Ladinig (2008), it is hard to imagine what reasons participants might have in fooling the experimenter in a musical context. In fact, no instances of hacking of Internet-based studies have been reported in the literature, and long-standing Web researchers regularly describe the lack of empirical evidence of such instances (e.g., Birnbaum & Reips, 2005; Reips, 2000, 2001). Maybe it is the relative unfamiliarity with Internet technology and methodology that makes some researchers extra skeptical of results obtained via the Web. Actually, Web-based experiments allow for far more control than is offered in a lab-based set-up. Since the full experiment has to be automated, it can also be monitored and traced in all detail (from reading and listening time to the location and amount of mouse clicks). Where we have to trust an lab-experimenter that the data are collected in the way described in the method section of a research paper, with Web-based experiments the reviewer can, in principle, inspect all stages of the experiment (cf. Reips, 2000, 2002b). In that sense we could argue that fraud is less likely for Web-based as compared to lab-based experiments.

That said, technology may of course interfere in ways that are different from the laboratory settings many researchers are used to (cf. Reips, 2002a; Schmidt, 2007; Schwarz & Reips, 2001). However, if effects are found with proper designs, and despite technological variance, then the argument for the effect and its generalizability is stronger, because of the additional variance on the Internet.

Which brings us back to the issue of reliability and validity. We agree that this is dependent on the research question at hand, and up to the judgment of the experimenter (Honing & Lading, 2008, p. 7). For the validity of much research, clearly Web-based studies have more potential. For instance, they offer a probe into daily musical experiences that can not be obtained in a laboratory (see, e.g., Dibben & Williamson, 2007; North & Hargreaves, 2007).

CONCLUSION

The decision to do a certain experiment in the laboratory or via the Internet often is a trade-off between the desire to precisely control a number of parameters, and the ability to generalize widely in presence of an effect. While Kendall (2008) is not convinced of the integrity of Web-delivered experiments and stresses the need for more methodological comparison studies, we think there is quite some evidence of this integrity in the literature (e.g. Birnbaum, 2001; Birnbaum & Reips, 2005; Honing & Ladinig, 2008; Ollesch, Heineken, & Schulte, 2006; Reips, 2000, 2002b).

Overall, both Web-based and lab-based experimenting bring up issues of method and design that need serious attention. While some of these issues were shown to be of a similar nature in both approaches, the advantages of versatility, ecological validity, and the potential large number of participants, makes Web-based experimenting a full-grown alternative, especially for empirical research in music.

NOTES

 [1] As an example, until recently the scientific journal *Cognition* rejected Web-based studies, while under the new editorship the journal does not make a distinction anymore between Web-based and lab-based studies (cf. Vrouwe, 2007). This is indicative of a changing attitude at most peer-reviewed journals treating Web-based and lab-based studies in a similar fashion.

[2] The interpretation that we "dismiss issues of University Review Panels" is incorrect.

[3] See, for example, the collections by John Krantz at http://psych.hanover.edu/research/exponnet.html and the web experiment list at http://genpsylab-wexlist.unizh.ch/ (Reips & Lengler, 2005).

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