



Working Knowledge

Working Together

The Experimental Design Hackathon

by
Hearing the Voice





**'The Experimental Design Hackathon'
A Project Short by Charles Fernyhough**

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The Experimental Design Hackathon

One of the challenges facing interdisciplinary research projects is converting rich cross-disciplinary conversations into practically realisable plans for empirical research. Planning experimental and other empirical studies requires an awareness of methodological constraints that can be highly discipline-specific as well as terminologically opaque. Study design is a substantial aspect of regular scientific disciplinary training at undergraduate level, and interdisciplinary research needs to support individuals from outside a particular subject area in understanding what can and cannot be done in creating and running a research project in that field. At the same time, perspectives from other disciplines can help to identify research questions and pose questions that lie 'outside the box' for the target discipline, making the challenges of interdisciplinary research design well worth tackling.

Hearing the Voice staged two experimental design hackathons in June and November 2013. They took place in the regular Voice Club sessions at the Institute of Advanced Study in Durham [see [Voice Club](#)]. **Hackathon 1** was facilitated by Mary Robson, the regular Voice Club facilitator, with additional input from Felicity Callard, an expert in interdisciplinary 'experimental entanglements'. Participants were told that specific preparation was not necessary; the idea was rather to try to capture and crystallise some of the ideas and conversations that had emerged from Voice Club, which had at that point been running for around eight months.

The event was initially designated a 'neuroscience hackathon', and was framed as addressing the following core challenge: **How can we put interdisciplinarity into practice in designing neuroscience experiments?** A stated objective was that, despite the foregrounding of neuroscience, the hackathon should aim to avoid privileging neuroscientific truth and claiming that it is more important than any other kind. Rather, the focus was chosen because as a result of a view that cognitive neuroscience was the area of research within the project that probably felt most unfamiliar to the majority of Voice Club participants.

Participants were offered the following (informal) definition of a hackathon:

It's a concept (stemming from software and games coding) in which a bunch of people are shut up together in a room and told to solve a problem. Time is strictly limited, and specific preparation is not expected. The intention is to bring people together and crystallise what ideas are already in the room into a workable plan: <http://en.wikipedia.org/wiki/Hackathon>

The 'problem' to be focused on was defined as follows:

Imagine that you had a ton of money to design a neuroscience experiment. What would you do? What would you be interested in? What questions is your own research pointing up for you? What do you think we need to find out, in terms of brain processes, in relation to the problems, challenges and insights that are most obvious to your from your (inter)disciplinary perspective?

The only preparatory work that participants were asked to do was in thinking about which research ideas from their work might turn into a scientific experiment. The event was presented as an interesting and potentially fun experiment which might be only partially successful, and whose format would likely require tweaking in any subsequent iteration. Above all it was hoped that it would be

“How can we convert rich cross-disciplinary conversations into practically realisable plans for empirical research?”

a useful learning process in addressing a core aim of Hearing the Voice, namely the practical translation of interdisciplinary research ideas into feasible scientific studies.

Fourteen members of Voice Club took part in Hackathon 1 and self-selected into four groups. The only constraint on group membership was that each group should include at least one expert in experimental design in psychology/cognitive neuroscience. Groups worked together for about an hour, including a tea break, and moved to different areas of the building and outside. The groups then reconvened in plenary session with each group presenting brief outcomes from their discussions, followed by whole-group discussion and evaluation.

Feedback on the process of Hackathon 1 suggested that some working groups naturally had great

er success than others. In order to ensure that the discussions were as unconstrained as possible, no attempt had been made to channel the discussions in particular directions, which some participants felt led to a lack of focus. Several groups came up against the problem of converting interesting ideas for studies into paradigms that would be feasible in, for example, the MRI scanner, where the very strict constraints on what

“*The paradigms that are being worked up are considerably richer than the psychology/cognitive neuroscience team could have achieved on their own.*”

participants can be asked to do were not familiar to many group members. There was also a general feeling, in the feedback on Hackathon 1, that more time should be allocated for the group work.

In preparing for **Hackathon 2**, more time was allowed for the group discussions. In addition, there was an effort to work out relevant questions in advance so that groups could focus on how to design experiments to answer them, rather than attempting to achieve both goals in the limited time available. Psychology PDRA Ben Alderson-Day presented a small number of PowerPoint slides which provided three specific themes (including a single overarching theme) for the discussions that had emerged from Hackathon 1.

Responding to the concern that some members of the group would be less familiar with empirical research techniques, the thematic introduction was followed by suggestions for specific tasks that could be employed or adapted to address the research questions. These were supplemented by research articles illustrating the use of relevant methodologies, which were sent out to participants in advance. Three groups (one for each sub-theme) were designated. After the introductions, participants were invited to self-select to the theme that most interested them, with the previous constraint that each group should include an expert in empirical methods.

Hackathon 2 generally benefited from the tighter focus on specific research questions and the additional preparatory work. Notes taken by each of the groups were collated into an extensive document that served as the basis for further discussions among the psychology/cognitive neuroscience researchers in finessing the experimental

paradigms.

Feedback on Hackathon 2 identified several methodological themes that had constructively emerged from the discussions. One key issue was group-members' familiarity with the sometimes counterintuitive constraints of neuroimaging research. Other issues were: understanding the nature of a scientific 'sample'; an awareness of the importance of statistical power and sample size; and questions around 'event capture' (specifically, how many times an event had to occur in the scanner to make its study meaningful). On a practical level, the importance of detailed note-taking by each group was also emphasised.

The experimental design hackathons in Hearing the Voice are a work in progress. A general lesson emerging from the process is that it is highly **labour-intensive** to convert interesting ideas generated in interdisciplinary conversations into paradigms that are feasible within an experimental setting. One important practical bottle-neck is the capacity of those with experimental design expertise to conduct this intensive work after the hackathons. Projects wishing to pursue such an approach need to ensure that sufficient resources are allowed in planning this process.

One central question in **evaluating** the success of the hackathons is whether anything was achieved that could not have been attained by constraining the discussions to the psychology/cognitive neuroscience team. Those involved agree that the paradigms that are being worked up are in many cases considerably richer than the psychology/cognitive neuroscience team could have achieved on their own. For example, we are developing an fMRI paradigm involving the reading of fictional texts in order to address a specific research question, an approach that would not likely have emerged without the input of humanities scholars.

Another key issue is that of **authorship**. Interdisciplinary authorship is an important general concern for projects like Hearing the Voice. Specific challenges are presented when ideas arise out of what may be fairly free-form initial discussions involving relatively large numbers of people. Besides ensuring appropriate representation of individuals on author lists, there is a practical issue in simply keeping track of who was involved in which discussions.

At the end of the academic year (after Hackathon 2) Voice Club participants were **surveyed** for their views on positive and negative experiences that

had emerged from Voice Club. The hackathons were mentioned by several participants as positive aspects of Voice Club: 'I had not thought clearly before about how the ideas and questions that derive from the humanities might need to be modified to be asked in a scientific paradigm. The hackathon idea, for example, was very exciting to me and I am keen to pursue this'; 'The neuroscience hackathon was a great example of how interdisciplinary engagement sets up valuable new thinking that can lead to new empirical studies'. Several people mentioned the hackathons among their 'three most memorable moments' from the year's Voice Club: 'Neuro-hackathon brought a lot of interesting ideas up'; 'The thrilling experiment of the hackathon: it was always going to be risky and I really didn't know how it was going to work'; 'Neurohackathon: because it was an important moment to see cross-disciplinary perspectives forced to mingle and interact, in so doing opening unexpected routes for experimental designs as well as making evident some hindrances'; 'Hackathon - as we got down to the nitty gritty of developing research questions'; 'I think it will be

fascinating to see what comes out the neurohackathon specifically and hope that we can develop these ideas further in future work'.

The ideas generated by Hackathons 1 and 2 are now being worked up into feasible experimental paradigms, some of which will be implemented in the course of the next year. Future plans for the hackathon format include focusing on approaches to therapy and management of voice-hearing, and thus extending the scope of the hackathon format beyond empirical study design.

A note on **terminology**: the hackathons were initially framed as having the potential to lead to new experimental designs in cognitive neuroscience. In time, 'neuroscience hackathon' became shortened to 'neurohackathon'. Although a convenient and attractive shortening, it was felt that the term unnecessarily privileged the neuroscientific, and excluded psychology and other disciplines, and that the more neutral 'experimental design hackathon' was preferable.

Working Knowledge is a collection of accessible and user-friendly resources dedicated to the practical ins and outs of interdisciplinary research.

Covering everything from managing a research project's social media presence to conducting experimental design 'hackathons', the series is a must-read for anyone considering funding or embarking on interdisciplinary research.

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