

UC Berkeley

Berkeley Scientific Journal

Title

Ming Hsu

Permalink

<https://escholarship.org/uc/item/2h35f74t>

Journal

Berkeley Scientific Journal, 22(1)

ISSN

1097-0967

Author

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Publication Date

2017

DOI

10.5070/BS3221037611

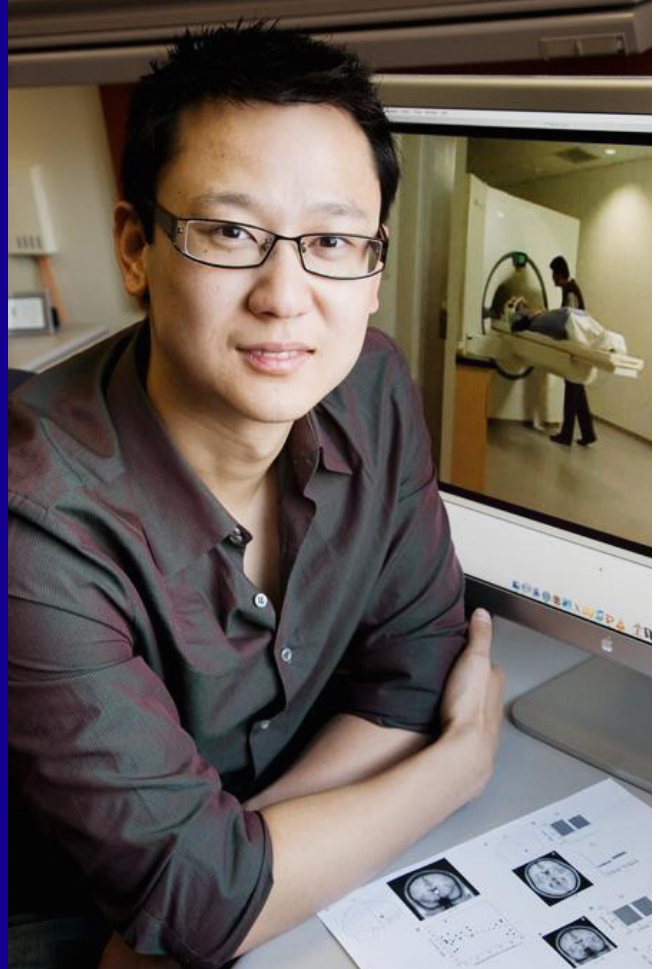
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Undergraduate

NEUROMARKETING: USING FMRI TO STUDY THE BRAINS OF CONSUMERS

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Ming Hsu is an Associate Professor at the Haas School of Business and Helen Wills Neuroscience Institute at the University of California, Berkeley. He received his Ph.D. in Economics from the California Institute of Technology and now heads a neuroeconomics lab at Berkeley that studies consumer choice and social behavior. In this interview, we discuss how fMRI can be used to study the consumer brain and brand personality without resorting to biased self-reports.

BSJ: Given your background in Political Science and Economics, how did you get into the field of neuromarketing?

MH: I think the common thread is the need for all of these fields to understand human decision-making. What distinguishes my work and that of those like me is that we also look into the biological mechanisms in addition to behavior and societies. How I got into the field is a bit more circuitous. As you mentioned, I studied Economics and Political Science as an undergrad at the University of Ar-

izona, but at the same time I was working in a cognitive neuroscience lab. That was when folks in the social sciences first started working with functional magnetic resonance imaging (fMRI). It was around that time that I saw a fascinating presentation from a group of economists who used fMRI to study how people made economic decisions. I thought that this was one of the coolest things that I had ever seen and soon started working with them. I had no idea at the time that these were economists of some renown, especially Vernon Smith, the director of the lab who won the 2002 Economics Nobel Prize. The second major influence was in my PhD studies working with my thesis advisor Colin Camerer. He has this sixth sense for knowing what is going to be the next generation of cutting-edge research questions. For example, before Caltech even had an fMRI scanner, he would tell me to design experiments applying brain imaging to economic questions, because he thought this was going to be a hugely important set of questions. Turns out he was completely right.

BSJ: What kind of information can neuromarketing extract from data that could be of interest to people in the field of marketing?

MH: The field is moving incredibly fast, so it's hard to say something that isn't at risk of becoming obsolete in the near future. But in general, I would say that we can use neuroscience to address some of the long-standing skepticism that people have toward self-report measures, like focus groups and surveys. We can use neuroscience to validate whether what consumers are telling us reflects what is going on in their brains. In the same way that people don't necessarily trust interviews, there is a lot of skepticism surrounding focus groups, so not everyone will report their true thoughts. We can use neuromarketing to avoid bias in consumers' answers and confirm that the information we derive from consumers' brains is consistent with their self-reports. We can also use neuroscientific tools to increase the precision of

our measures; for example, consumer engagement. Finally, we can use neural measures to forecast how consumers will react to a branding or an advertising campaign. Can we scan a brain and figure out signatures that are going to allow us to project what's going to happen after the product is launched?

BSJ: In your research you talk about several methods that you use for brain response imaging. Can you go over briefly what these methods are and why you chose to use fMRI specifically?

MH: There are three primary imaging methods used in human neuroscience: fMRI, electroencephalography (EEG), and positron emission tomography (PET). PET is largely reserved for medical imaging because it involves injection of radioactive tracers. So for neuromarketing we are typically talking about fMRI and EEG only. In terms of how we choose a specific method, the primary tradeoff is between cost and portability on the one hand, and the anatomical specificity on the other. If you care about portability and are on a limited budget, EEG is the likely choice because fMRI requires a 3-ton machine that costs about \$1 million, so good luck wheeling it into a movie theater, for example. The downside of EEG is that it doesn't have very good spatial resolution, so you can't easily tell which brain



Figure 1: Difference between (a) the range of consumer choice in the laboratory and (b) the range of consumer choice in the real world.¹

regions are contributing to your signal. So if you care about where things are happening in the brain, fMRI is the better tool.

BSJ: In one study,³ you used machine learning and fMRI to study brand personality—human-like characteristics that consumers associate with brands, like excitement, competence, sincerity, etc. Could you explain for our readers what this brand personality framework is and how you mapped neural activity in certain regions of the brain to specific brand personalities?

MH: Brand personality is the idea that people can think about brands in anthropomorphic terms. For example, people rate Campbell's Soup as high in terms of being "wholesome," or Google as being "imaginative." It is intuitive but sometimes

controversial because, beyond self-reports, there are few ways to actually validate what consumers think about a brand. For example, a skeptic can argue that people don't spontaneously think of these attributes without being explicitly prompted by the questionnaire. What's missing is the possibility for objective independent verification, very much like DNA evidence in forensic analysis. Our answer to this is to put people in an fMRI scanner. In the study you mentioned, we asked them to think about well-known brands like Gucci, Apple, Google, or Ford. After the experiment, we asked them to take the brand personality survey. We then showed that we could use their brain activity to predict how they would describe brands in the subsequent survey. Because our participants didn't know about the survey when they were being scanned, there was no risk that questions could bias their thoughts during the scanning session. This method is not perfect, but it provides some of the first indications that we can use the brain to validate consumer self-reports, much like DNA evidence can be used to validate the account of a witness.

BSJ: In the same study, how were neural responses to brands extracted and then mapped to one of the five personality features?

MH: This is where we used ideas from machine learning. We used 42 out of 44 brands as a training set to develop a predictive function for brand personality based on a pattern of brain activity. We learned how consumers respond to different brands and tried to explain this re-

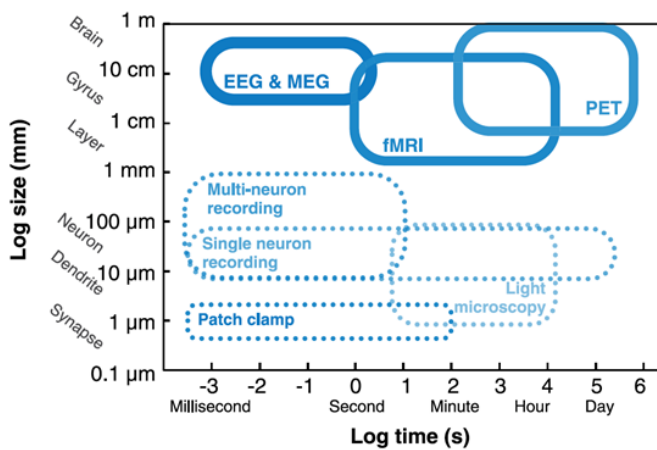


Figure 2: The technology used to study the consumer brain. While EEG is very popular because it is not very expensive, fMRI offers higher spatial precision.²

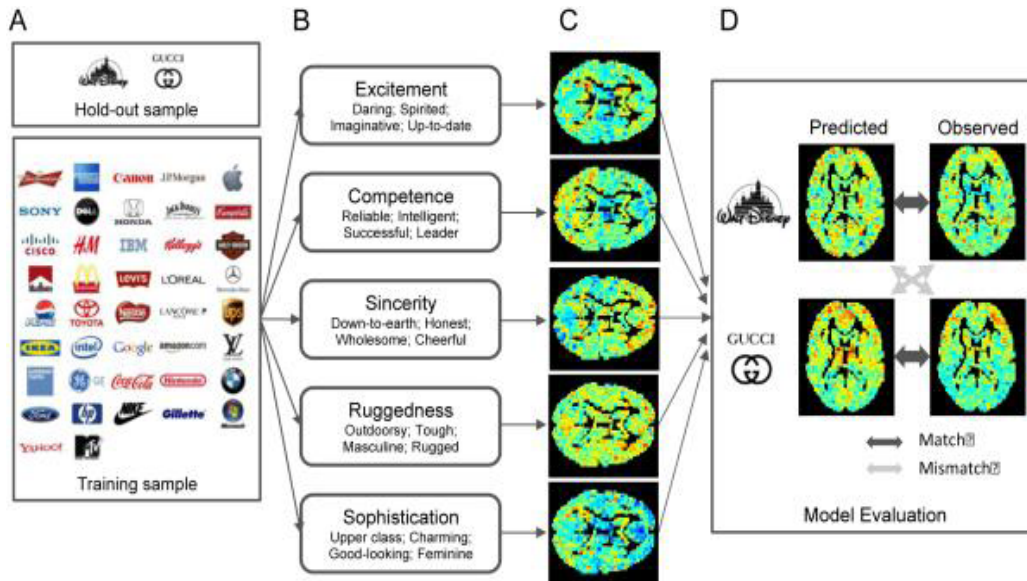


Figure 3: This figure from Ming Hsu’s study³ maps how the scientists use hold-out and training brands to create a brain map of the five personality features from which consumer responses to unknown brands can be predicted.

sponse in terms of five personality traits: excitement, competence, sincerity, ruggedness, and sophistication. We used two “hold-out” brands to check whether we could correctly predict brand personality based on the information derived from the training sample.

BSJ: What are the ethical implications of studying the brains of consumers with fMRI?

MH: Let me give an example first involving a collaboration of ours with a sports team. There, one question that we could have asked was, “How can we use the brain to figure out what prices people are willing to pay for tickets?” Or, “How can we figure out what people would like to pay, and what price would extract the maximum amount of profit?” That would have been a really terrible study. The fans would’ve hated it. The team would hate it because they, hopefully, care about what the fans think. Instead, we asked, “How can we use neuroscience to help the team figure out how to deliver a better fan experience?” That is a question that can benefit everyone! More generally, I think this is a challenge facing every new technology, from neuromar-

keting to genetics to artificial intelligence. They can be used with destructive consequences, but also for positive ends. These technologies are simply tools, and the way we use them often determines whether they have destructive or positive consequences.

BSJ: If you were giving advice to a student who wants to do research in the future, what would you say?

MH: Get involved early, whether as a research assistant in a lab or an internship in a company! Start doing what you are passionate about. Also, try to select an area where you have a comparative advantage. For example, when I started neuromarketing, this area of research was new. I was able to pick up the material even faster than my advisors because I had more time. There are so many exciting things that are happening! I’ve had students start creative new research projects because they follow the most recent developments in AI, social media, and other technological advancements.

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