



THE WORLD OF “BIOMETRICS”

and Where Psycho-Physiology Fits in It:

The term “biometrics” has been applied to multiple disciplines as a method of collecting behavioral or physiological measurements of the body. While information-overload can make these tools seem intimidating, a lot of valuable research can come from proper use of physiological metrics.

Fingerprints, cardiac activity, electromyography (EMG) and skin conductance are all examples of biometric measures. Even something as simple as a signature is considered a form of biometrics. How? Because the signature is an authorization output created via the body. A signature can be reliable; however, not necessarily valid. As technology advances, there are newer, more secure methods of biometrics being exercised as a means of verification. Such tools are becoming more embedded into our everyday lives through monitoring events such as health, physical fitness or security. Facial recognition software is used to open your iPhone, while Amazon’s Alexa can interpret spoken command of your personal voice. Companies are more frequently using biometrics as a form of identification, such as when carrying out financial transactions or boarding a plane. In marketing, biometrics has infiltrated the field to provide additional information about how consumers respond to an experience.

The definition of biometrics is vague, allowing a lot of tools to be included in it. Yet, not all biometric tools and outputs are utilized the same way. When a physician takes your heartrate, those measurements are being analyzed differently than when market researchers collect the same outputs. The application of biometrics within the context of consumer science has strong connections to psychology. The biometrics used can be specialized as a form of psycho-physiology, since bodily measurements are integrated with the psychology of the consumer to develop actionable results. Psycho-physiological tools differ from biometrics because they involve an analysis of the interaction between body and mental processes. To help understand how industry is embracing the world of psycho-physiology, below are a few frequently asked questions about HCD’s psycho-physiology capabilities, limitations and overall use.



1 What biometrics do you employ?

We have a wide range of biometrics tools available to cater to specific research needs. Skin conductance, facial electromyography and heart rate are often bundled together as a powerful psycho-physiological combination. Electroencephalograms (EEG), behavioral coding and facial coding are also measures we employ that may help achieve research goals. HCD's objective is to identify and use the proper tools to gain valuable insight into your research question. Along with the biometrics and psycho-physiology tools, we often include eye-tracking in our research, as well as various traditional and psychological tests. If you are interested in learning more about these specific tools and capabilities, please see the HCD White Papers.

2 Oh, so the biometric tools are like a lie detector?

A common misconception about biometric research is that we can tell if the participant is lying. While it makes for great moments in Hollywood, there is absolutely no way of proving deception or personal thoughts via biometric data. Furthermore, biometrics should not be used to replace simply asking participants their opinions via a survey, interview or focus group. Generally, most participants are honest, and sample size is strategically chosen to decrease the margin of error by minimizing any outliers that may skew the data. Doing biometrics on its own can present a challenge since it lacks context. From our experience, a fusion of biometrics and traditional research tends to be the most effective way to understand the overall experience.

A traditional lie detector or polygraph test is intended to monitor psycho-physiological changes in the body while the participant is asked a series of unstandardized questions. While the set-up of the physiological components of a polygraph test have similarities to the psycho-physiological tools we use, there is no way to prove lies from changes in the body (APA, 2004). Most professional scientists, as well as the United States Supreme Court, reject the polygraph test for its inherent unreliability.

3 What is the best tool?

Each tool can be the best tool—it just depends on the specific question being asked. At HCD, we start with the research question and then implement the tools that are most appropriate for what we are looking to uncover. We have a toolbox consisting of traditional, psychological and neuroscientific methods that we can leverage to best answer your specific questions.

4 Will you be able to determine if someone is going to purchase the product?

We cannot guarantee buying behaviors based on biometrics. Our tools allow us to deep-dive into the stimulus and determine how participants react (or disengage) with specific components of a product or communication. Patterns in the biometric outputs allow us to predict the overall consumer experience with the stimuli and diagnose problems or effectiveness in products, ads and concepts. Meaningful outputs that we analyze and interpret are a far cry from reading someone's mind.

5 Can biometrics assess liking?

While there are certain psycho-physiological measures that correlate with liking, such as skin temperature, it is much more direct (and cheaper) to use a survey. Rather than try to determine if a stimulus is likable, our tools allow us to better understand what is driving or hindering likability. Discovering windows of opportunity through psycho-physiological or cognitive survey tools can gauge consumer expectations versus experiences. These methods can push your research further by diagnosing areas to improve upon or emphasize in order to hone in on the core message.

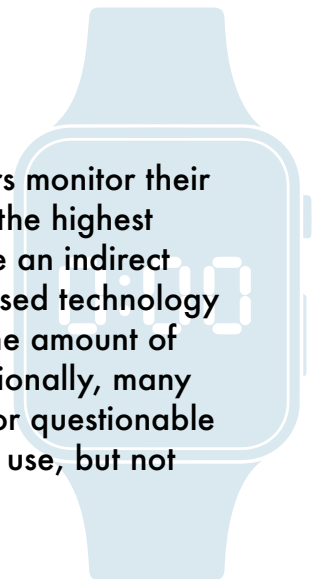
6 Can you predict how a product or commercial will do in the market?

Studies have tried to make the link between sales in market and neuroscientific measures. Comparing eye tracking, biometrics, traditional self-reports, implicit measures, EEG and fMRI to determine the strongest predictor of market success excited advertisers. The results suggest that fMRI performs best as an effective tool to express advertising elasticities (Venkatraman et al., 2015). While this type of research is necessary when pioneering an interdisciplinary field, the results come with a plethora of caveats. To run a fMRI study, a medical staff and hospital or clinical setting is necessary. Recruiting participants for an fMRI study is upwards of thousands of dollars, while the fMRI machine itself ranges from \$500,000 to \$3 million. The unnaturalistic environment the participants must endure (remaining perfectly still in the scanner) is a challenge to compare with real-life scenarios. Another common critique of fMRI research is surrounding the conclusions drawn from reverse inferencing. Essentially, the fMRI provides output on brain activity through blood flow. Yet, activity in the brain can have many interpretations since neural structures have multiple functions. Oversimplifying the abilities of the brain to fit the mold of commercial research results in muddy findings. Hence, the fMRI machine may be more expensive and less informative than what clients initially anticipated.

Rather than create a prediction as to how something will perform in market, we provide exploratory and diagnostic tools to learn the important drivers of a purchase. The combination of explorative and diagnostic research allows us to better understand why a consumer uses a product, the behavioral response to the item, as well as the rewards resulting from the interaction. Understanding the cues of the consumer gives insight into windows of opportunity to increase content engagement. These need gaps and innovation opportunities can be useful when trying to drive a purchase.

7 Can't you just wear a Fitbit?

For widespread use, Fitbits and Apple watches are a great tool to help consumers monitor their exercise. Unfortunately, the technology utilized in these devices is not always of the highest clinical-grade standard. Wearables lose accuracy with movement and tend to use an indirect method known as photoplethysmography, PPG, to measure HR. PPG is a light-based technology that measures the rate of blood flow. Tattoos and certain skin tones can hinder the amount of light that can penetrate through the skin, thus influencing the PPG reading. Additionally, many consumer-grade biometric devices interpolate or "algorithmically fill in" missing or questionable data, making it look like a reliable data feed. This can be appropriate for casual use, but not always a good idea when making business decisions.



Contrastingly, higher-end wearables, such as a medical wearable, can provide effective information. However, valuable wearable technology is expensive and still generally utilizes PPG. We encourage the use of equipment that can directly measure what is being studied. For HR, suggest using EKG to gain that immediate measurement.

8 Is the equipment portable?

Yes- most biometric equipment is 100% portable. HCD can conduct psycho-physiological research anywhere in the world.

9 Can everyone/ anyone be measured with biometrics?

Yes, although some participants are better respondents than others. This can be for a multitude of reasons depending on the specific type of biometric being utilized. Certain populations, such as infants or children, may be limited in what types of physio-physiological tools can be employed on them.

10 What is the typical sample size?

Sample size is subjective based on the type of research being conducted. For a general consumer test including psycho-physiological testing, we recommend at least 25-30 participants.

11 How much does it cost?

It depends on the complexity and scope of research. Typically, the addition of psycho-physiological testing to a central location test (CLT) accrues an additional 30% in cost. If the research is being complemented with online quantitative measures, the value for psycho-physiological testing is closer to an additional 40%.

Integrating implicit association testing (IAT), on the other hand, only adds a few thousand dollars to testing whether it is conducted online or at a central location. These general projections may vary based on the specific type of research being conducted. HCD is happy to brainstorm what type of research would be most appropriate and cost effective for your needs.

12 Do participants feel anything?

No! Technicians are specifically trained to help make the participant feel comfortable and to ensure open communication throughout the experiment. There is a two-minute acclimation period to become adjusted to the feel of the equipment. If at any point the participant feels uncomfortable for any reason, the technician analyzes and addresses the situation to defuse any uneasiness. Making sure the participant is comfortable is important for a strong reading; therefore, any questionable data is disregarded. If a participant ever feels extremely uncertain or uncomfortable, we end the session early and disregard the data. Over the course of our 10+ years conducting this type of research, this is an extremely rare occurrence.

13 Can you run multiple people at the same time?

Yes, but with limitations and hesitations.

Focus groups should not be integrated with biometrics since the relationship among various participants would interfere with the data. Running multiple people in one space creates an increase in variability, loss of control and invites additional bias into the group dynamic. It also makes it much more challenging to parse out what specific contributions are causing the response in the participant. Is the response from the stimulus, another participant in the room or both? This is a very difficult (or nearly impossible) question to answer.

However, even with these concerns, certain forms of research can feasibly have multiple participants viewing the same stimuli simultaneously. The technician must be cognizant of interruptions or artifact that can influence the data; however, a space, such as a theater, promotes minimal interaction with surrounding audience members.

14 How do you account for artifact/noise?

Artifact or experimental noise can be anything that unnaturally influences the biometric reading. Eating, coughing, and blinking are all different forms of artifacts. Similarly, environmental noise includes interruptions such as barking, car alarms or a baby crying. The technician is trained to pick up on both environmental or physiological cues that may hinder data collection. Any concerns are noted and reflected upon in the cleaning process. Additionally, all biometric measurements are collected with a baseline reference to assist in determining acceptable spikes or dips in the output.

15 Can biometric tools be used in all testing environments?

This is a tricky question to answer, and the short answer is that it depends on the goals of the research. Biometric tools are very sensitive. While setting up the biometric sensors, we take extra precautions to ensure a steady connection. Being in a controlled environment is helpful when trying to minimize any excess noise or unnecessary variables. The type of biometric tool used has specific testing limitations; however, in general, best practice is to minimize movement that creates a lot of artifacts. Riding a wobbly rollercoaster with ten other screaming passengers while hooked up to some biometrics does not leave much room for valuable data to draw conclusions. By getting creative and thinking outside the box, the HCD team works diligently with clients to develop a study approach that promotes reliable responses relevant to the research motives.

16 Can you do brain scans?

Before answering this question, it is important to clarify a common misconception. **Neuroscience research is not just brain research.** While the brain is an awe-inspiring organ and has a lot of incredible mysteries to still be discovered, we experience the world with our entire body. The nervous system generally is broken down into two groups: central nervous system (CNS) and the peripheral nervous system (PNS). The CNS consists of the brain and the spinal cord, while the PNS includes all the nerves that extend to the rest of your body. Neural communication

throughout the CNS and the PNS has messages firing constantly to adjust and adapt to our surroundings. Using all five senses, we develop personal associations that act as the foundation of our decision-making process. To get a fully immersive understanding of how your product or messaging is being perceived by a target audience, it may be advantageous to consider diverse ways to analyze the complexities of the human experience. Integrating other biometric avenues, psychological tools or traditional marketing approaches can lead to comprehensive, impactful findings.

Neuroscientific measures are often grouped into one category of central “brain” measures, such as functional magnetic imaging (fMRI), positron emission tomography (PET), functional near-infrared spectroscopy (fNIRS), or electroencephalogram (EEG). Quality machines that can create beautiful brain scans come at a cost, with equipment alone having a price tag in the millions. However, EEG does have consumer-grade options that give insight into activity on the surface of the brain. The EEG can provide a global perspective on what is occurring globally during a specific task or stimuli. In order to conduct valuable EEG research, a controlled environment is crucial due to the sensitivity of the sensors measuring electrical pulses. During this developmental process, you want to ask yourself how EEG (as well as any of the research tools implemented) will enhance your research. Does EEG contribute valuable information to your findings? If so, we work together to develop a plan that meets your research goals while being aware of the EEG limitations. To compensate for components where EEG is limited, we often recommend complimenting EEG with some type of cognitive research to ensure relevant and informative findings.

17 What areas of the brain light up when someone wants to buy something?

The phrase “light up” is derived from the use of functional magnetic resonance imaging (fMRI) measuring increased blood flow to a brain structure, suggesting increased activity. However, brain structures can be activating or inhibiting when activity is heightened. Similarly, brain structures have multiple functions that may not relate to purchase intent at all. The brain is extremely intricate and interconnected, making it impossible to find one singular “buy button” in the brain. Areas of the brain are associated with multiple, sometimes contradicting, experiences. For example, the amygdala is known for fear and arousal. If the amygdala lights up when looking at a sign, we can’t assume that someone is scared or excited just because a spike appeared in one recording.

Using fNIRs, fMRI, or EEG can provide interesting insights about an overall experience; however, electricity doesn’t flow from a neuron to one electrode (Biasiucci et al., 2019). Crosstalk, variability and artifact can make it difficult to conclude detailed findings about a product or message eliciting an emotion due to a specific area of the brain reacting.

18 Why don’t you use biometrics for every project?

Honestly, biometrics is not and shouldn’t be always necessary. Instead of leading with high-tech approaches, we always recommend starting with the research question and then choosing the methodology that is most appropriate and will provide the most accurate and actionable results. It is important to circle back frequently to the research question when trying to determine how to develop an appropriate approach to uncovering the answer.

It is very exciting that we have the potential to implement technology such as fEMG or skin conductance into our work; however, **just because you can doesn't mean you should**. You must ask what purpose each measure is adding to the research. If the tool is not adding value to the overall answer, it may be best (and more cost-efficient) to leave it out. If you are trying to make a better chocolate chip recipe, why make note of the color of the oven? Keep focused on relevant tools that are appropriate. Open communication, coupled with critical thinking, helps optimize any research plan and ultimately, deliver strong findings.

Selecting what measures to exercise in research can be daunting, but clarifying the business objectives upfront allows for time to digest what tools would be best to utilize. Sometimes keeping to traditional marketing methods is sufficient, while other questions benefit from a biometric component. Biometrics can provide additional information beyond traditional measures. For example, biometric tools aid in uncovering answers that may be challenging for the participant to verbalize. Employing biometrics into research can be very valuable in providing new insights into consumer experience research.

IF YOU HAVE ANY QUESTIONS OR WISH TO LEARN MORE ABOUT HOW HCD
RESEARCH CAN HELP YOU APPLY THESE TECHNIQUES TO YOUR RESEARCH,
PLEASE FEEL FREE TO CONTACT US VIA EMAIL INFO@HCDI.NET.

CITATIONS

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