Overview of Quantitative Methods in Design Research

STACEY PURPURA

Using statistics to improve design seems to contradict the field's inherent freedom and creativity. Yet the field of design often uses quantitative research to inform anything from practical considerations (i.e., time-to-task completion) to refining theories about interactions with designed objects through the validation of exploratory research findings. Through quantitative studies researchers and designers can link attitudes to behaviors and set benchmarks to gauge improvements. This chapter provides an overview of how quantitative design research helps us understand how to make things simpler and easier to use, how quantitative research can be used to find the "best" product by a nose through the use of experimental design, and how it can marry attitudes and behaviors in a way that can inform design decisions. While qualitative research that casts a wide net and gradually refines its research objectives, quantitative research is used once research objectives are defined.

Most of my personal experience with quantitative design stems from the development and enrichment of technology-based products and experiences. During the past few years I have lived in the rarified air of Silicon Valley, and although those years saw the deflation of eCommerce and web design, they are also the years during which principles of design and design research came to the fore. As a rising tide raises all boats, during the unharnessed development of the web successful developments came about through an unflinching emphasis on iterative design and user or consumer experience. In this case, "experience" is understood by marketers and designers alike as extending beyond a person's immediate interactions with a product to all experiences with that product in all of its incarnations. In the past years, we learned through clicks and mortar that experience can be virtual as well as physical. For example, a poor experience with a website for a certain brand could lead to a perceived poor experience with the product itself. Design isn't merely about the object but the extensions of the object through its communications with the end user. In this spirit we will explore quantitative design research in different permutations for finding the right audience, identifying their needs, testing usability, and conducting validation and brand research.

Whereas qualitative research is typically used for casting a wide net on a topic, the exacting nature of quantitative research is used to pin down the details

BEGINNING
Assessing the Potential Market and New Product Opportunities; Needs of the Consumer (subconscious and unmet)

MIDDLE
Feature Testing, Usability Testing

END
Refining Messaging and Branding

Quantitative Research in the Design Process

of the research. Iterative design moves projects forward without leaving the end user behind. Research is often left until after the product is well past the design stage and ready to bring to market. But there are certain phases at the beginning, middle and end of the design process when quantitative design research can successfully inform the design of products and processes. This isn't to say that quantitative research should take the place of qualitative research, but that it has a distinct place and value of its own, especially in an iterative design process when you are looking for incremental gains and benchmarks.

Research at the Beginning: Working with Thought Leaders

It's great to use research to understand your potential market, but what if you don't really know what your market is, or worse, what your product is? Can you still benefit from doing research? The answer is an unequivocal "yes"—if you do it properly. The "beginning" refers to the concept stage when ideas are most mutable and fragile. At this stage, researchers and designers must tread lightly to ensure they don't kill good ideas. Going out with a color-preference survey to an undifferentiated mass audience would be inappropriate or even damaging at this stage. At the very earliest stages of the design process, certain market segments should be tapped: early adopters and the fringe. For the remainder of this chapter we will follow a hypothetical "bleeding edge" technology/clothing/housewares company trying to get a product to market. In reality this process would inevitably be iterative and cyclical, but in the interest of time I'm going to run straight through without the Chutes-and-Ladders game that usually takes place in iterative design.

> *Company Y decides that they want to develop products based on smart fabric with embedded computer chips. The problem: Company Y has not yet decided what kinds of uses this new type of fabric has or what kind of functionality the chips that are embedded in it will have. At this stage they have only conceived the idea and think it is time to send up a trial balloon. Company Y's first challenge is to make sure that the right people see the trial balloon.*

TALKING TO THE RIGHT PEOPLE

The general population has a tendency not to use or adopt products until they are proven. Logically they are not the target for early research, since they are not really the target audience for an innovative product when it first comes out. However, early adopters and people on the fringe tend to find new uses for old products and adopt emerging products at the earliest stage or generate new ideas. Thought leadership isn't a democracy.

Leaders can be identified through key characteristics such as a propensity to learn and an avid love for all things new. If you are planning on doing research with this population I recommend taking the time to get to know this very special audience through a qualitative study. Their experiences differ from ours—well some of ours, anyway—and therefore they may have different criticisms, ideas or uses for products, and they have an inclination to like change. Once you know where they are coming from you will know what you can ask them. In the world of research these people can be identified and used as a barometer for all kinds of emerging ideas, typically through concept testing.

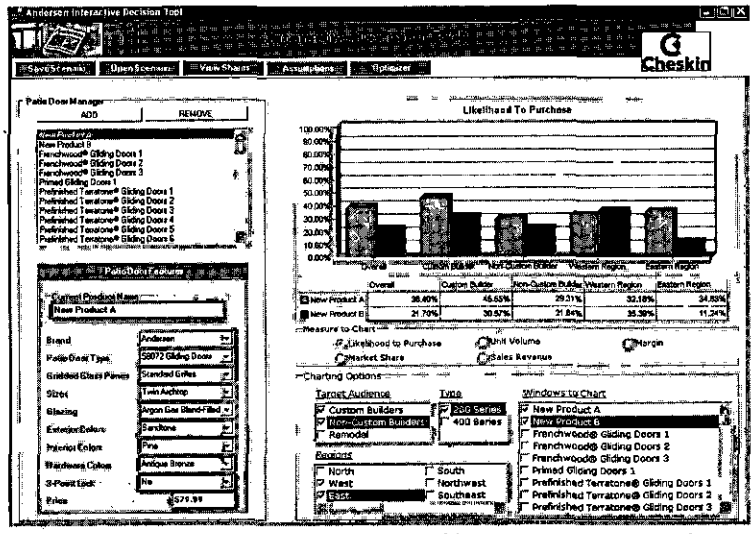
CONCEPT TESTING

Concept testing allows you to take a few ideas out to your audience of early adopters and put them to task. One of the benefits of doing a concept test quantitatively is that a clear winner usually emerges from a few concepts. In concept testing, you are going to have to help respondents along with some kind of stimuli—words, pictures, or a rough prototype. Don't waste their valuable input on something they can't envision. Stimuli can be based on brand-new ideas or old ideas repackaged in a new way—just make sure that the stimuli capture the essence of your idea. The most useful questions at this point are how unique and relevant the concepts will be to the audience. Concept testing can provide direction when two or more contenders are in the ring and there is no clear winner.

> *Company Y knows their capabilities for creating computerized fabric but cannot decide between computerized clothing or computerized towels and bedding. There is little contention that the material in the product will have some computerized functionality but a map of the market is unclear. Company Y performs a concept test to see which of these uses excites their core early adopters most. As a result of concept testing they have a clear idea that, while it is nice to have a towel that will fluff itself according to how wet or dry you are, the concept of having clothing you can communicate through is rated as significantly more unique and relevant to most early adopters. Their next step is to understand what features could be included (and which should not be) to flesh out the concept of communications togs.*

FEATURE TESTING–BEGINNING TO MIDDLE

Features can make a product; they can also overload and destroy it. Occasionally designers have absolute creative freedom to include or exclude features based on their own sense of what makes a design sing, but these opportunities are rare. Another way to understand which features hold water is through a discrete choice analysis. This type of study controls respondents' exposure to specific features or concepts of a product that are then tested against one another. Feature testing should be used, like concept tests, when there is no clear winner from qualitative research, and especially if pricing is an issue in the development of features. The name "feature testing" may be misleading, because the goal is actually to understand how people will react to the entire package, with all of the features included, sometimes accompanied by a price tag. Respondents will be exposed to a single example of each of the hypothetical designs one at a time. This is best done through computer simulations; otherwise, such tests can make the development process very expensive. Based upon the results of feature testing, the designer or researcher will be able to understand which features are deal-makers and which features are potential deal-breakers and at what price.



An interactive tool to represent potential customers' responses to product features.

Company Y is now thinking about the actual design of the product. Where should they put the computer chips and where will they allow the communications functionality to reside? Will consumers tolerate having wide lapels on their talking clothing for better reception? Will they want clothing that will allow them to have a private conversation? Can clothing that meets consumers' desires for certain kinds of functionality be fashionable? What design features will satisfy that goal? Company Y takes their hypotheses and generates models with them, creating models with different combinations of features. Then they launch a computer survey that allows consumers to view the models and to evaluate not only the features, but the entire package. Company Y then has a clearer idea of what their customers would tolerate, what they would actually enjoy and how much the product will be worth to them once it is actually on the market.

Research at the Middle: Usability

Usability studies tend to be quantitative in a different way than many market researchers think because they need not employ 30 or more subjects. The sample size for these studies may be small, but they can generate a large amount of data. Their insights come from metrics such as time-to-task. The value of such studies is the ability to determine whether a product is usable in a timely enough manner to satisfy the audience to which it is geared.

Time-to-task methods will always require a prototype near completion so the user can be seen in action. Designers may use information from such studies after the basic work of design is completed. If a designer feels that the design is only about 80% effective, data from such studies may enable them to inch effectiveness up incrementally by 10% or more. This is the best use of usability studies that employ metrics such as time-to-task.

It's important to remember that usability testing is not "likability" testing. Someone may like the cornflower blue icon today and hot pink tomorrow, but Usability research is focused on helping the designer make the product more compelling and usable through little tweaks to its functionality.

While natural work environments should be used during the contextual design phase of the research, usability studies are best performed in a controlled environment such as a laboratory. Because the goal of time-to-task research is to assess how long it takes a subject to complete a particular task (which may be one in a series of tasks to complete an entire experience), it is ideal to not have the participant interrupted. The focus of usability research is on the in-depth detail of the user's interaction with the product. Small, incremental gains may seem ridiculous when we are talking about products designed for leisurely use, but imagine a situation where time is of the essence—the emergency room for example, or a diabetic's need to inject insulin. Incremental gains in a time-critical task may turn out to provide tremendous gains for individuals.

> *Company Y has developed a prototype, a model of the communicative clothing, with the optimal features they have identified included in the physical model. Company Y can now test this with individuals and assess whether or not the clothing is operational. How long does it take, for example, for one of their customers to figure out how to send a message? If it is an option, how long does it take for customers to enter text? The point of these timed exercises is that all of the features may be in place but none of them may be working appropriately for the user in a timely manner. Obviously, the design will fail if it is simply too difficult to figure out or use. After testing, Company Y discover it happens to have had a resounding success with the wide lapels and collar model, because customers can turn their collars up to listen to incoming messages as quickly as the message comes in.*

Research at the End: Validation and Standardization

At the end of the product development or research cycle you may want to validate your findings with the relevant audience. Quantitative validation means that you are confirming what you heard from a smaller group of people with a larger and hopefully representative group of people, if you have designed the study correctly. In order to validate findings from qualitative studies, a sample of at least 30 individuals should be used. These individuals must be exposed to the same types of stimuli you used in the qualitative phase.

DON'T EXPECT TOO MUCH

Depending upon the stage of the project, validation studies can be enlightening or disastrous. The reasoning behind validation is to confirm what you think you learned from the qualitative stage of your studies. But using quantitative measures to test your hypotheses is a little like feeling the trunk of the elephant or shining your flashlight on a certain place in the darkness—you aren't going to sense as much as you did with your qualitative study. This is intentional; the goal of quantitative study is to reduce rather than to add complexity. The interaction of qualitative and quantitative studies within an entire research process is a dance of expansion and contraction of possibilities, but always moving toward an optimized design.

Let's say we tested a prototype amongst a core group of users. The users of this prototype were in direct contact with a model. Hopefully, they were able to describe their responses in detail, and you were able to observe nuances of how they interacted with the model. Asking directed, standardized questions about their experience or observing subjects' experience with a limited set of features reduces the points of possible contact with the subjects. Result: one level of juicy complexity removed. Given the timeframe and the larger sample size, users will, in all likelihood, not be directly interacting with the prototype itself in the same way they had been during the qualitative phase. Result: another level of complexity and interesting findings is lost. This is a fair bargain at this late stage in the process because in exchange for the reduction of complexity you receive defined benchmarks from which to take steps for improvement.

A quantitative study necessarily limits what you are able to investigate, and it's important to recognize that you are working within a set of defined parameters. Constraints can be good and instrumental in focusing a product. The neatness and measurability of quantitative work necessarily means a trade-off between depth and breadth.

Research at the End (and at the Beginning): Segmentation and Brand Experience

Although it may not immediately come to mind, we can use numbers to uncover who our audience is and how they relate to a particular product and brand. Quantitative segmentation using advanced statistical techniques can refine and define an audience. Segmentation studies examine how certain groups of people hang together ⊙253 WRIGHT. For design purposes, we can uncover how these groups cluster together according to different attributes such as demographics, behaviors or attitudes. Using segmentation analysis it is possible to pinpoint key segments, such as the early adopters discussed above, and from there measure and improve their brand experience to develop stronger loyalty and wider adoption and usage. The advantage of quantitative segmentation in this regard cannot be understated. Understanding an audience in depth is key to making improvements, incremental and otherwise. The task is vastly easier when it can be clearly stated with whom a brand or product is excelling and with whom it is falling short. The objective of segmentation research is to get a picture of the general audience and the sub-audiences for a product or a brand.

To be most useful, segmentation studies should ideally take place after the product has gone to market. A segmentation study can tell you who your core audience is and who are the malingerers on the outskirts. It can also tell you who likes to use your product, how much of the market share they make up and how much they buy. Segmentation can also show you how to make your brand stand on its own. For example, brand maps are a terrific way to get a read on brand territory. At a glance, you can see which brands share, or have ownership over, traits typically associated with a group of brands. For example, a clothier may want to know which brands in the brand space are associated with being high-end, youthful, mature, trusted, sexy or classic. Some brands often share the same attributes with other brands, while other brands have sole ownership over a brand trait.

> *Company Y is now marketing their wide-lapelled smart clothing to hip young people, but they want to expand their audience. What is the next group they can take it to? Who is the best audience? They perform a segmentation study and discover that older people who are slightly techno-phobic also like the clothes. It's also uncovered through the segmentation that business people on the go can be another market for their products. At this point the company can go back to the drawing board to find ways to appeal to these new markets through specific changes in both product design and branding.*

Quantitative methods have contributions to make at every stage of the life of a product or brand. They also provide information necessary for the renewal and change that characterizes the life cycle of a successful company.