WHAT EVERY DESIGN ENGINEER SHOULD KNOW ABOUT DESIGN RESEARCH

Lecture by:

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Part Two
Methods of design research

Product development is a field of intellectual and creative human activities where the endeavors are streamlined towards creating products and services. In its broadest sense, product development refers to a purposeful combination of knowledge from different disciplinary fields such as psychology, marketing, innovation, ergonomics, form-giving, material engineering, product technologies, process engineering, and information technologies. Depending on the focus, design research applies a wide range of research methods. Basically, design research can be empirical (observation driven) and rational (curiosity driven). An empirical research cycle relies on observations, experimentation and measurements. Empirical research involves induction with the intent to describe, explain, and/or predict phenomena in various design contexts. A rational research cycle is based on conjectures and consideration of basic theories, and is concerned with the exploration, development and testing of new knowledge. Likewise empirical research, rational research also intends to describe regularities, to explain relationships, and predict future occurrences. Engineering design research is interested in looking at cause-effect relationships.

The methods used in design research can be paired and contrasted based on their methodological characteristics. The first contrasting pair of characteristics comes from the abovementioned *empirical* or *rational* nature of methods. In terms of the intrinsic logic of reasoning, research methods can be *deductive* and *inductive*. Deductive research methods start out from a hypothesized or empirically tested or testable truth, and use it to prove some hypothesis or theory by logical inference. Inductive methods start out from observations and measures, and first try to detect and recognize certain regularities, relations or patterns in the observed facts. Then they form tentative hypotheses based on the recognized patterns, and develop a new theory or rule by proving the hypothesis. The third pair of opposing characteristics is *nomothetic* and *idiographic*. The goal of nomothetic design research methods is to explore general knowledge, in particular, cause-effect laws and relationships. Opposingly, *idiographic* design research methods concentrate on exploring laws or rules, together with the conditions of validity, which relate to individual cases. The idiographic studies prefer seeing knowledge as local and situated.

Research methods can also be distinguished based on whether they are *qualitative* or *quantitative*. Examples of quantitative methods now well accepted in design research include statistical survey methods, laboratory experiments, and numerical methods such as mathematical modeling. The qualitative research methods are oriented to a non-quantitative observation, exploration, and description of phenomena. Their potential lies in capturing semantic relationships and generating qualitative theories. They try to exploit human verbalism and interpretation. Examples of qualitative methods are such as field observation, in-depth interview, action research, case study research, and ethnographical survey. Further, research methods can be classified as '*emic'* or '*etic'* based on the relationship of the researcher to the studied phenomena. In the case of 'emic' or participatory research methods, the researcher is directly involved in the observed phenomena. They try to exploit the ability of human beings to talk, but they often interfere with the studied phenomenon - that is not the case with 'etic' methods. In other words, 'etic' and 'emic' methods represent an outsider and an insider perspective, respectively. Another aspect of classification is *descriptive* or *prescriptive*. Descriptive research methods describe how the things are, while prescriptive methods specify how the things ought to be. Prescriptive methods provide norms for design - therefore, they are regarded as normatively instrumental.

The tutorial includes concrete examples for the design research methods and their application.