

The effect of abductive reasoning on concept selection decisions



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This study examines the effect of the form of logical reasoning on concept selection decisions. An experiment was conducted with members of a committee called upon to decide whether or not to invest in new product concepts. Under an abductive reasoning frame manipulation, which induced an inclination toward a form of logical reasoning that introduces hypotheses to explain given observations, individuals were more likely to accept concepts whereas under a deductive reasoning manipulation they were more likely to reject concepts. We recommend that when committees aim to increase the likelihood of design concepts being accepted, decision makers should employ innovative abduction to think creatively about new ways to frame the proposed concepts and to explore new working principles underpinning them.

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Design concept selection is a fundamental aspect of the design process, especially in new product development. Long before a new product hits the market, decision-makers were trying to decide whether to further develop, consolidate, or abandon one or more product concepts. Individuals engaged in decision-making applications of this type are making strategic choices about potentially attractive design concepts such that after the decision is taken, they or their company would devote considerable and irrevocable time, money or both. This problem has become more widespread as an increasing number of companies implement an 'Innovation Time Off' policy to elicit new product concepts from employees or implement an open innovation policy of 'crowdsourcing' product or service ideas (Bayus, 2013). In other words, companies are facing a large stream of ideas, and are struggling with the filtering and selection process. Ideally, they need to balance the number of projects that make it through the early selection stages without taking on poor projects but equally without filtering out projects that may turn out to be valuable innovations. In companies failing to innovate due to high levels of risk aversion, they may simply need selection processes that get more projects through the early stages of

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filtering. This paper takes on the question of the effect of the form of logical reasoning on design concept selection.

A concept selection process (Ulrich & Eppinger, 2004) or an Idea Screen (Cooper, Edgett, & Kleinschmidt, 2002) takes place toward the beginning of a product development process. During the selection process, decision makers perform design evaluation, by which we mean the determination of the quality (value or worth) of a design concept against established objectives as a function of one or more its attributes (Thurston, 1991). Current design evaluation methods call for deductive logic, which is a form of logical reasoning that aims to guarantee the truth of the conclusion if the premise of the argument is observed to be true. In other words, the evaluation methods aim to prove or disprove the merits of the concept. Empirical evidence in industry for this type of decision context describes decision-makers as tending to apply variables amenable to deductive analysis including product timing, staffing, and platform when evaluating innovative projects (Krishnan & Ulrich, 2001; van Riel, Semeijn, Hammedi, & Henseler, 2011). Product concept evaluation techniques as a consequence employ highly deductive analysis requiring a substantial amount of information aiming to prove or disprove premises established by precedence (Udell, 1989). Empirical metrics applied in assessing creativity in design projects even at an early stage similarly require deductive analysis, such as in quantifying novelty by comparing an idea to a universe of ideas (Maher, 2010; Shah, Smith, & Vargas-Hernandez, 2003). In logical notation, in which p is a premise and q is a conclusion, the deductive logic applied by a decision maker in quantifying novelty could be:

$p \rightarrow q$	IF positive novelty evaluation metric (p) \rightarrow THEN creative (q)
p	Design concept has a novelty metric greater than zero (p).
q	The design concept is creative (q).

Similarly, the evaluation techniques can call for inductive reasoning, in which the premises provide a degree of support for the conclusion. Based upon an observation made about the proposed design concept, a decision maker establishes a hypothesis to explain the observation. The hypothesis is a generalization of the observation; it does not introduce any new information explaining the particular observation. Induction can only establish truth relative to the current observations. As more evidence in support of the premises become available, the degree of strength of the conclusion increases. With inductive reasoning, the goal is to accumulate evidence to support or refute the hypothesis. An inductive reasoning example could be:

$p_1 \rightarrow q_1$	Product 1 employs voice-based input and is inadequate.
$p_2 \rightarrow q_2$	Product 2 employs voice-based input and is inadequate.
$p_n \rightarrow q_n$	Product n employs voice-based input and is inadequate.
$p \rightarrow q$	IF voice-based input (p) \rightarrow THEN inadequate (q)

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