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RT Delphi: An efficient, "round-less" almost real time Delphi method ☆

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Abstract

The authors have recently developed a new approach to performing a Delphi study that does not involve the use of sequential "rounds" and as a result, greatly improves the efficiency of the process and shortens the time to perform such studies. This paper describes this process, RT Delphi, and illustrates its use in a decision-making application drawn from the Millennium Project of the American Council for the United Nations University. The illustrative application involves setting priorities among strategies for dealing with anticipated terrorist activities that might be initiated by a single deranged individual.

Keywords: Delphi; Ontology; Artificial intelligence; Futures methodology; Futures research; Foresight; Conference room Delphi; Real time Delphi; Natural language processing; Decision making; Real time decision making; Policy research; Experts studies; Roundless Delphi; On line Delphi; Millenium Project

1. History of the method

The Delphi method was developed at the RAND Corporation in the late 1950s and 1960s as an effective means for collecting and synthesizing expert judgments. Since the first RAND study was published 1964 [1], the technique has been used very often across a broad spectrum of topics. It is a principal method of

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futures research and has found application in planning, decision making, and policy research. For a discussion of the method, see [2–4]. Participants are carefully chosen for their expertise in some aspect of the problem under study and are promised anonymity with respect to their answers. In general, Delphi studies involve feedback of information from one round to the next, including (for numerically answered questions) the average or median of responses, and typically, reasons furnished by participants for holding extreme positions. The method is certainly not limited to numerical applications, however.

The process tends to move the group's responses toward consensus, although reaching consensus is not necessarily the central objective or a measure of success of such studies. It also produces a set of reasons behind the responses. The value of the Delphi method rests with the ideas it generates, both those studies that evoke consensus and those that do not. The arguments for the extreme positions also represent a useful product.

The method has had myriad applications but has also drawn a number of criticisms, including the long times involved in accomplishing such studies [5].

In September, 2004, the Defense Advanced Research Projects Agency (DARPA) awarded a Small Business Innovation Research grant to Articulate Software, Inc. to develop a Delphi-based method for improving the speed and efficiency of collecting judgments in tactical situations where rapid decisions are called for. The grant was based on a decision making problem: a hypothetical decision maker, uncertain about tactics that might be followed in accomplishing a specific objective, calls on a number of experts to provide their judgments about value of the alternative approaches. Delphi was specified in the grant as the method to be employed. The objective was to improve the speed of the process, to real time if possible (hence the name: RT Delphi). The number of participants representing different areas of expertise was assumed to be small, perhaps 10–15 people. The RT Delphi design is particularly applicable in this situation: synchronous participation, a small number of participants, rapid completion required, but can be used when participation is asynchronous, the number of participants is greater, and more time is available.

A second aspect of this grant which will not be described in detail here was to utilize advanced artificial intelligence (AI) and natural language (NL) processing in analyzing the non numerical responses of the Delphi. When incorporated, advanced AI, largely invisible to the user, would improve the process through the use of a formal ontology, to harmonize language and meaning, involve theorem proving, to catch clashes among participants, employ natural language understanding, to get user input to a form the machine can "understand," and introduce automation to allow for larger groups or a faster process, because work is offloaded to the machine. This aspect of the system is currently a research prototype and the subject of future work. Additionally, NL processing will be useful in identifying duplicate inputs when the language used by two respondents is not precisely the same and in clarifying or eliminating logical inconsistencies.

The NL component of this work is called the Controlled English to Logic Translation system (CELT) [6,7]. CELT accepts a simplified form of grammatical English. Although the complexity of the linguistic input is limited, the system has a 100,000 word-sense vocabulary. In order to capture the meaning of the linguistic input in a form suitable for machine understanding, we use a formal representation stated in mathematical logic. The logical representation, called the Suggested Upper Merged Ontology (SUMO) [8], is more general than the original English, although also more precise and formal. SUMO and its associated ontologies cover roughly 5000 formal concepts. An additional component is a system than can automatically perform automated deduction on the logical representation, and is called Sigma [7]. We connected these components to the web-based Delphi matrix interface, providing a demonstration of