Available online at www.sciencedirect.com

ScienceDirect

Procedia Manufacturing 00 (2015) 000–000

SAND2015-2748C

Procedia MANUFACTURING

www.elsevier.com/locate/procedia

6th International Conference on Applied Human Factors and Ergonomics (AHFE 2015) and the Affiliated Conferences, AHFE 2015

Developing a Capability to Elicit and Structure Psychosocial Decision Information within Computational Models

Michael L. Bernard

Sandia National Laboratories, 1515 Eubank SE. Albuquerque, NM, 87123, U.S.A.

Abstract

There is a recognized need to develop computational models that can represent and simulate the decision making process of various groups across socio-cultural domains [5]. Yet, developing such models can be greatly hampered by the need to acquire and represent information pertaining to the psychological and social aspects of decision-making within these groups. Currently, there are numerous techniques and tools to help facilitate the elicitation and structuring of knowledge within expert-type systems—particularly those that focus on technical processes such as mechanical troubleshooting [3]. However, few techniques and tools have been developed for models that are intended to represent and assess the decision making of groups within different societies—particularly including cultural elements within these societies. This paper seeks to help address this challenge by discussing an approach to eliciting and structuring cross-cultural psychosocial and behavioral-economic elements within a theory-based assessment model. This work was developed to address the needs of Sandia National Laboratories' Behavioral Influence Assessment modeling capability, which assesses decision-making within societies. The main component of the knowledge engineering effort is what we call the "knowledge structure." The knowledge structure acts as scaffolding for the organization of psychosocial processes underlying decision-making, as well as the actual content of that knowledge with respect to a modeled group of individuals.

Keywords: Knowledge Elicitation; Knowledge Structure; Cognitive Modeling; Social Modeling; Systems Modeling; and Country Assessments

2351-9789 © 2015 Bernard, M.L. Published by Elsevier B.V.
Peer-review under responsibility of AHFE Conference.

1. Introduction

With the development and rapid growth of expert systems in the mid 1970s, the need to generate methodologies to both acquire and store expert knowledge has proportionally grown as well. Expert systems comprise of a broad range of applications that include, among others, tutoring, training, problem solving, and legacy systems. A common feature of expert systems is the computer-based application of expert knowledge to help in the decision making of some process. Typically, this has been oriented towards a mechanical process, such as the construction, maintenance, or repair of some object or system. This type of knowledge-based system emphasizes the use of human experts as a primary source of information and the use of a "knowledge schema" as a basis of its implementation [1]. Accordingly, this type of system stresses the need to capture relevant knowledge and formalize it in a computational structure that can emulate, as close as possible, expert knowledge. Because of this, one line of research has stressed the need to better understand the mental structures underlying expertise and represent this structure in a knowledge schema that is as close as possible to the actual cognitive processes of humans [1]. This process of knowledge acquisition generally includes the initial elicitation of knowledge from a subject matter expert (SME), as well as the explication, coding, and presentation of knowledge [2]. These processes can, however, vary in accordance with the specific needs of the task and the degree of rigor imposed on this process. Currently, there are numerous techniques and tools to help facilitate the elicitation and structuring of knowledge within expert-type systems—particularly those that focus on technical processes, such as mechanical troubleshooting [3]. These techniques range from unstructured and structured interviews to the development of ontologies and entity-attribute grids [see 2, 3, 4 for further discussion].

Apart from the more traditional purpose and approach of expert systems is the need to capture, store, and represent the mental and behavioral properties of human populations. Hence, the "expertise" that would be captured in such a system is related to how a population within a certain society generally thinks and behaves. Thus, an extension of the type of expert system mentioned above is one that attempts to capture the cultural "mindset" of certain groups regarding some specific concept or situation. To help accomplish this, one would need to develop a computational model that could represent and simulate the decision making process of various groups across socio-cultural domains [5]. Developing such a model is hampered by the need to acquire and represent information pertaining to the psychological and social aspects of decision-making within these groups. Few techniques and tools have been developed for models that are intended to assess the decision making within different societies, particularly regarding cultural elements within these societies. Thus, what has yet to be adequately addressed is the elicitation process underlying decision making with respect to personal (relationships, self-achievement, etc.), societal (domestic policies, laws, etc.), and/or geopolitical (diplomatic, military, trade, etc.) properties of populations and sub-populations (i.e., groups). The information associated with this type of elicitation could be considered much more abstract and difficult to obtain. It is also more difficult to assess the veracity of the information, since it is based more on the experience, training, and "gut feel" of an SME. A question, then, is how can this type of knowledge be effectively elicited from an expert so that it is useful in the development of a psychosocial computational model? Secondly, and perhaps more importantly, how can this information be structurally represented within the model? This paper describes an initial attempt to both elicit and structure psychosocial information within a computational framework that reflects the cultural diversity among various groups.

2. Acquisition of psychosocial knowledge

As stated by Sieck and collogues, "An inherent challenge in understanding behavior in other cultures rests in gathering, analyzing, and representing the relevant cultural concepts, beliefs, and values that drive decisions in those populations" [6, p. 237]. Accomplishing this task is understandably difficult. However, there are a number of approaches that, in combination, can take us closer to a more accurate representation of human decision-making. Unfortunately, relying solely on current knowledge acquisition approaches will not, in the opinion the author, capture the main essence of decision-making in this domain. It is argued here that methods that both elicit and structure decision information in a manner that grounded in decision theory will provide a richer, and potentially more accurate, representation of decision making.

Kenneth Ford and collogues [7], as well as others [2] have advocated a theory-based approach to knowledge acquisition. Indeed, knowledge acquisition methods have been enhanced through the use of psychological [1, 2, 4, 8] and social theory (such as Cultural Network Analysis; [9]). For example, psychometric scaling techniques that include cluster analysis [10] and multidimensional scaling [11, 12] have been used to represent knowledge by assessing the level of similarity of concepts with other. Specifically, knowledge is characterized in a manner where each concept is placed in N-dimensional space to show the conceptual distances between each concept. Another example is entity-attribute grids that cluster concepts according to their attributes in order to make conceptual relationships more apparent [13, 14]. Hence, a large portion of work, as it relates to psychology, has been applied to the process underlying the extraction and association of conceptual information. These techniques apply research-based theory to help represent the elicited information. These methodologies promote "exploration of the conceptual framework of a domain of expertise by encouraging experts to operate in a "brain-storming" mode as a group, using differing viewpoints to develop a rich framework" [13] p. 341. While this can provide an important contribution to the representation of knowledge underlying expert problem solving, it contributes less to the representation of the psychosocial processes underlying descriptive decision-making. Indeed, one's perceptions and underlying attitudes, motivations, and emotions typically affect the framing of socially related decisions.

To help capture psychosocial information associated with decisions, and the process underlying it, Sandia National Laboratories' Behavioral Influence Assessment (BIA) program has developed an initial approach for eliciting and structuring this type of information (see [15, 16, 17] for further discussion of BIA). Obviously, a task such as this needs to be constrained as much as possible in order for it be realistically achievable. To accomplish this, both the elicitation process and the structure itself use theory and procedures developed in the fields of psychology, sociology, behavioral economics, and system dynamics to help guide and constrain the knowledge acquisition process. The main elements of this process generally consist of 1) formulating a problem question, 2) representing broad-level societal interactions, and where needed, 3) elicit psychosocial information pertaining to key actors using the developed "knowledge structure."

2.1. Developing a problem question to model

To begin conceptualizing a psychosocial model, we start by working with customers to identify a target problem to model and the specific questions the model will be used to answer. That is, for the model to be useful, it should simulate a problem (rather than a system). Modeling the problem helps to focus the model boundaries, questions to answer, and project tasks. Customer interests determine the choice of problem to model. The broadness of the problem will help to determine the level of detail in the model; a very broadly defined problem will result in a high-level model, whereas a more targeted problem can lead to a more detailed model. The process of deciding the problem question is typically determined through open-ended questions with the customer. In this process, it is determined which major components of the system should be included within the model. Once a problem is defined, the customer and modeling team work together to specify questions that the model should answer. The questions focus on issues that are at the same level of detail as the model problem. The set of questions (and sub-questions) will likely evolve, to some degree, over the course of the modeling effort. The specific modeling focus and time horizon of the simulation is typically identified at this point. As an illustration, we can start with an overarching question, "*how can instability within a country (socioeconomic strata and/or developed party loyalties) impact the country's interactions with NATO*?" This illustration will be used help explain our knowledge acquisition approach.

2.2. Determining experts

Determining who should be an SME is critical to this type of effort. The level of expertise, type of expertise, and the type of educational background are all very important elements to consider. Assessing the level of expertise is typically difficult to formally measure. For example, a learned professor who can speak and read the language of the society of interest might be a superior SME than a local non-academic, but not always. Namely, an SME might have formally trained cross-cultural expertise but not local expertise in a particular culture. However, cross-cultural expertise would provide the opportunity to assess local practices with respect to other cultures. Also, SMEs could have a variety of educational backgrounds. For example, they could have a social science or engineering degree, depending on the needs of the effort. Because of the potential contributions of each type of SME, using multiple SMEs (with different types of relevant backgrounds and skills) has the potential to greatly enhance the richness of model. Moreover, instead of pooling SME knowledge into an aggregate, developing separate models for each SME would enable comparison between experts. This could also help make apparent bias and differences in levels of knowledge. That is, each SME would produce their own representation and, thus, would be accountable for their information contribution. For example, an anthropologist and a psychologist might provide common information in some areas, but vastly different information in other areas. The areas of commonality can help provide information confidence, but differences between SMEs could provide interesting contributions that are unique to each SME.

2.3. Broader, societal system representation

Once the overall question has been determined, the representation of key influencers from organizations and conditions that produce the overall dynamics within and between entities can begin. Sub-system structures may also be included to represent physical and economic processes within the broader system. The representation of this information can be accomplished using a number of methods (The development of BIA models uses a hybrid, cognitive-system dynamics methodology; see [15]). Whatever method is used, psychosocial theories that address innate human tendencies can be a way to help initially structure the representation of behaviors the model is intended to simulate. For example, one of the core theories that we use at this level of representation is prospect theory. Prospect theory states that decisions are generally based on potential value of losses and gains rather than their final outcome and that the losses and gains are evaluated using certain heuristics [18]. Thus, a greater weighting would be placed on groups avoiding losses (such as in war, finances, etc.) than pursing greater gains.

Information pertaining to specific behaviors of populations can be obtained via SMEs. This is typically an open-ended, iterative process of adding information, assessing the interconnections and effects, and then adding new information to support and expand on the previous information. A method used to represent this information is via a causal-loop diagram (CLD [19]). A CLD can embody elicited knowledge within a structure constrained by theory (See Figure 1, as an example). As the structure is developed, domain information is used to add specificity. Using the illustration question above, a CLD could represent the interactions of different populations, the government, and exogenous variables, such as external violence. The CLD then can be mapped to a stock-and-flow diagram that explicitly details the flow of information and (physical) quantities through the system. A key feature is the designation of stocks that represent things (the "flows") that accumulate. These stocks largely characterize the nature of the system and its responses. Through this process it is determined which entities should be modeled at a more detailed level to represent their individual decision-making.

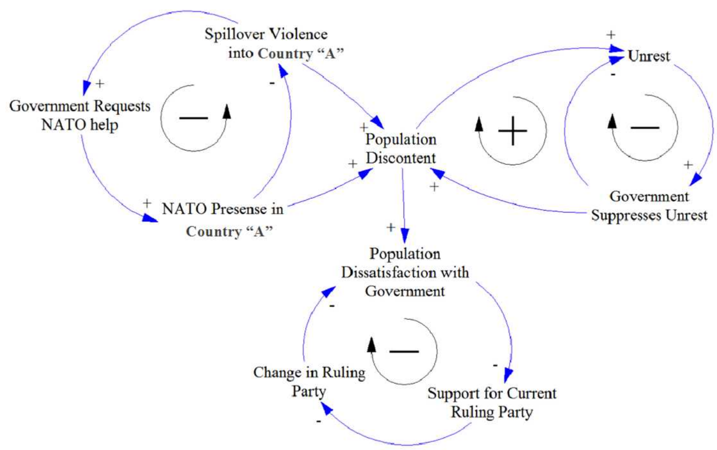

Fig. 1. An example of a causal-loop diagram

2.4. Psychosocial Knowledge Structure

Working with SMEs (and often customers), we can determine if elements within the model would benefit from higher resolution representations. For example, if a society that is represented contains several key actors (such as political parties, religious/social groups, etc.) that drive a significant percentage of the interactions, a more detailed representation of these actors might prove useful. The higher resolution representations are modeled within the BIA 'knowledge structure.' One can think of a knowledge structure (KS) as scaffolding for the organization of socio-cognitive processes underlying decision-making, as well as the actual content of that knowledge with respect to a modeled individual, type of individual, or group of individuals. A KS describes the relationships that lead from the marshaling of relevant stimuli in the form of "cues" to the performance of probable behaviors for modeled entities. It incorporates very specific cognitive information such as cognitive perceptions, motivations, attitudes, emotional states, and potential behaviors associated with particular situations. Importantly, this information is structured in a manner that should reflect the processes underlying both highly deliberative, as well as highly reactive human decision-making—taking into account behaviors associated with what is considered "rational" and also "irrational" thinking. This typically includes capturing particular biases, cultural thinking, general practices, and the frequency and recency of behaviors.

Unlike a general database of information, a KS links cognitive information in a manner that is consistent with psychological, social, and behavioral economic theories of human decision-making. The theories that are most prominently represented in this KS are: 1) the model of recognition-primed decision making (RPD) [20]; 2) the theory of planned behavior (TPB) [21]; 3) an extension of theory of planned behavior, the model of goal directed behavior (MGB) [22]; and 4) cognitive dissonance theory (CDT) [23]. All of these theories describe how people make decisions when faced with various situations. The RPD focuses on how relatively quick decisions are made based on interpretations of external cues. The TPB focuses on how decisions are made based on prevailing attitudes, social norms, perceived behavioral control, mediated by intentions. The MGB extends TPB by adding emotional affect, desires, recency, and frequency variables. The CDT focuses on how cognitive/behavioral discrepancies can affect views towards one's one behavior. Integrating the described theories into a single framework can be achieved because each theory generally complements each other. That is, RPD (and other related theories) contribute to the notion regarding how stimuli affects cognitive appraisal via perceptions of the environment. Cognitive perceptions can then trigger specific attitudinal-emotional beliefs that will help frame the situational context. Social norms and the perception of behavioral control contribute to the desire (what we call motivation) and, ultimately, the intention to perform some type of behavior. This cognitive process is discussed indirectly in TPB and is prominently featured in the MGB. Broader theories, such as prospect theory described above, should complement these theories as well.

2.5. Populating the Knowledge Structures with Information

SMEs can collectively contribute to the societal system representation and separately to the KS. This process consists of two steps, the initial population of the KS and the process of conditioning and refining it. Populating the KS begins with initial, theory-based, "default" settings regarding how humans generally perceive, reason, and act on their environment. The SMEs then refine and provide specific decision-related information pertaining to the problem question. This is accompanied by relevant studies, surveys, and reports that can provide additional, objective information to populate the KS. This process begins with an SME listing potential behaviors (PB) that may occur within the domain of interest for each actor being modeled. The list should include both likely and unlikely, but possible, behaviors. Continuing the illustration example, we could have several actors that would be modeled at this level. There could be a government and rival political party and several key social/religious groups. The PBs for the rival political party could include such items as, 1) *Increase vocal support for policy towards NATO*, 2) *Increase vocal support for policy against NATO, etc.* The Delphi method can be used during this process, which provides an effective way to conduct elicitation while reducing biases that can be caused through group interactions [24]. Accordingly, each SME separately lists the PB within the KS spreadsheet for each modeled actor. The elicitor then assembles the collected information and gives the group's collective responses back to the experts. The modeling team works with the SMEs to ensure that the granularity of each PB is appropriate for the model. Once the set of PB is listed, the next step is to list cognitive perceptions (CP) that can ultimately lead to the described PB (See Figure 2). A CP is defined here as an actor's psychosocial interpretation of some attribute or state as it is occurring. Because of this, a CP will be strongly mediated by the culture and history associated with the actor being modeled. Also, differences in culture, history, etc., may cause similar stimuli to be interpreted differently, which may, in turn, activate different CPs. That is, when a CP rises to full consciousness it is compared to a CP "template" that is stored in long-term memory. These templates serve to categorize/classify and structure one's belief of the world.

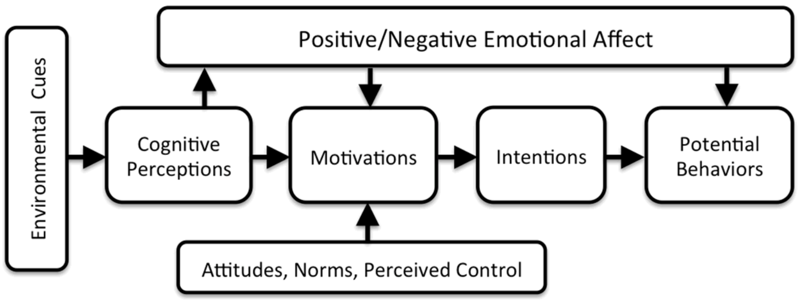

Fig. 2. Simplified view of the BIA knowledge structure

The process of eliciting CP is similar to eliciting potential behaviors except there is an attempt to derive overarching CPs to account for the various potential behaviors. The listing of core CP is an iterative process. Continuing the illustration example, CPs for the modeled political party could include such items as: 1) *External threats to government stability,* 2) *Greater government corruption,* and 3) *Weakening of the political party, etc.* The CP of external threats could increase the potential for the first PB to become active, while the second CP could increase the potential for the second PB to become active. The third CP could activate either PB, depending upon which behavior promotes the greatest popular support for the group.

Once the list of PB and CP are completed, each SME lists conceivably measurable (although not necessarily actionable) environmental cues that can contribute to the triggering of each CP. As with eliciting potential behaviors, cues are elicited via the Delphi method where each SME separately produces an initial list of cues. Conceptually, when external stimuli are recognized as cues, a certain pattern of pattern of cues can, and often does, produce a CP pertaining to a specific situation. The listing of cues is meant to reflect this concept. When this is completed, each SME identifies links between the lists of cues and the CPs. Each CP must have at least one associated cue. If not, that perception should be eliminated. Conversely, if there are cues that do not have an associated CP, then a CP should be added or the cue should be eliminated. A CP might be prompted by the appearance of only one or two cues, while other CP might need to be prompted by a large number of cues. This depends on the intricacy, the prominence, and interrelatedness of the cues associated with a particular cognitive perception. Cues can have different levels of granularity, depending on assessment needs of the analyst. Thus, in one application the cues may be fairly course-grained, whereas in another, the cues could be very fine-grained. This process of listing and connecting cognitive attributes to each other serves to help create logical consistency within the psychosocial model. Following the illustration above, for the political party, potential cues could be: 1) *bombing in Capital,* 2) *militias forming near country border,* 3) *head of security found guilty of corruption,* 4) *$1.2 billion missing from treasury,* and 5) *militant caught bribing government official.* Cues 1 and 2 might be linked to CP 1 and cues 3 and 4 might be linked to CP 2. Cue 5 could be linked to both CPs. Also, each cue may contribute differently to the evidence that a specific CP is active. To do this, each cue has a weighting associated with each CP. Thus, some cues might have high weights, indicating they strongly contribute to a CP, while others have weaker weights, requiring a greater number of cues to activate a CP. In the BIA model, an analyst might activate a number of modeled cues that are indicative of some situation in order to assess potential outcomes. As these cues are activated, this pattern of active cues may activate one or more CPs. This activation progresses throughout the model to ultimately generate a PB.

An active CP can prime one or more motivations to perform a PB. Thus, the next step in this process is for the SME to list the probable motivations that drive each listed PB. This list may be guided by external sources, such as surveys and reports, or SME opinion (based on social norms, attitudes, and perceived behavioral control. Norm and attitude information might be provided by surveys). Motivations are fairly high-level action tendencies, which can help direct the intentions of the actor being modeled. An illustration of potential motivations for the political party could be: 1) *Strengthen political power*, 2) *Increase party loyalty, etc*. The SME identifies links between a CP and one or more motivation (understanding that multiple CP can lead to a single motivation, and any given CP can lead to multiple motivations). Also, the SME identifies links between motivations and one ore more PB (understanding that multiple motivations can lead to a single PB, and any given motivation can lead to multiple PB). The degree of behavioral control (high, med, low) that the modeled actor has for each PB is then listed (for example, the political party may have high ability to support a leader but low ability to elect the person). The perception of behavioral control is an important factor in both theory of planed behavior and prospect theory. Additional elicitation can include asking the SME to indicate how often and how recently each PB has occurred for the modeled actor in the past and how PBs are likely to change with specified changes in the related CP.

For several of the theories mentioned above, emotional affect (positive and/or negative) is an important variable in determining PB. For example, in the MGB positive and negative emotions, along with attitudes and norms, is associated with the desire to perform some type of behavior. Accordingly in the KS, SME are instructed to indicate which CP is likely to produce higher amounts of emotional affect associated with each PB. Also, for each PB where emotional affect plays a major role, the SME may identify how each CP is likely to affect the intensity of the PB through emotion. When the KS is completed for each actor, the SME is instructed to judge reasonableness of the results, including cues, CP, motivations, emotional affect, and PB. This activity involves connecting each cognitive element so that the KS is coherent throughout the structure. This procedure is iterative in that constructing the KS as a dynamic system typically uncovers variables not previously considered, resulting in spiral development (addition or subtraction) of potential behaviors as well as cues and CP that instigate those behaviors. Also, the PB within a KS for one actor can be used as cues for other modeled actors. The procedure of doing this serves as an internal check where each psychosocial element must support each other so that it converges to an acceptable model. It must be stressed that the elicited information used to populate the KS should be considered a hypothesis as to the anticipatory decisions and behaviors of the modeled actor. As such, it is considered an estimate of the decision-making properties of the modeled actor and serves as a constraint on the formal parameter-estimation process. The use of uncertainty quantification techniques can then determine the importance of, and thus the need for, additional data.

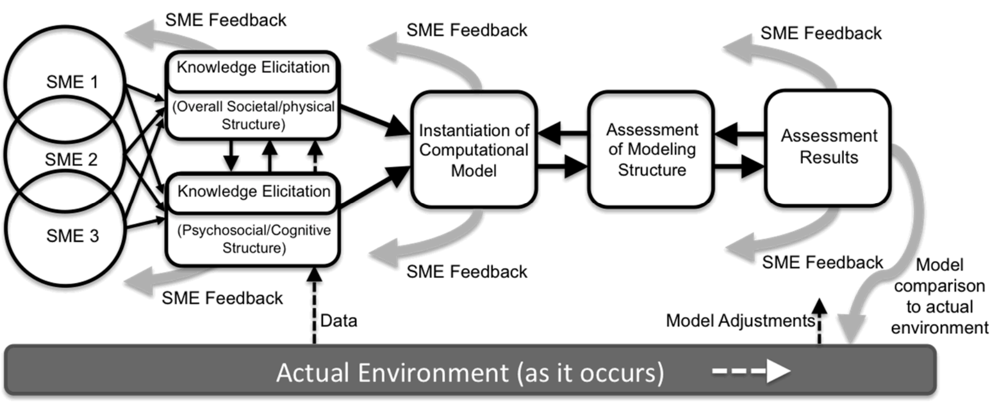

Fig. 3. The process underlying the development of the BIA knowledge acquisition process

As a complete structure, this information can be assessed and calibrated with actual behaviors of the modeled actor. Once the KS is developed it is instantiated within a computational model to be further calibrated and assessed by the SME. This assessment process continues as the computational model is further developed and visually expressed in assessment outputs (see Figure 3). The model output is then compared to the actual environment it was intended to model. While the process and structure of the KS is still in development, it has been used to produce multiple models representing a number of societies (western and non-western) and behaviors (e.g., voting, migration, protesting, etc.). While the process and structure of the KS is still in development, it has been used to produce multiple models representing a number of societies (western and non-western) and behaviors (e.g., voting, migration, protesting).

Acknowledgements

This research was possible in part by funding from Sandia National Laboratories is a multi-program laboratory managed and operated by Sandia Corporation, a wholly-owned subsidiary of Lockheed Martin Corporation, for the U.S. Department of Energy's National Nuclear Security Administration under contract DE-AC04-94AL85000. Approved for unlimited release: SAND

References

[1] B.R. Gaines, M.L.G. Shaw, The Knowledge Engineering Review, 8 (1993) 49-85.
[2] N.J. Cooke, Knowledge Elicitation Handbook of Applied Cognition Handbook of Applied Cognition
[3] M.L.G. Shaw, J.B.Woodward, Modeling Expert Knowledge, Knowledge Acquisitition, 2 (1990) 179-206.
[4] M.A. Meyer, J. M. Booker. Eliciting and analyzing expert judgment: a practical guide,7. SIAM, 2001.
[5] Canna, 2013
[6] Sieck, W. R., Rasmussen, L. J., & Smart, P. R. (2010). Cultural Network Analysis: A Cognitive Approach to Cultural Modeling. In D. Verma (Ed.), Network Science for Military Coalition Operations: Information Extraction and Interaction. Hershey, Pennsylvania, USA.: IGI Global
[7] Ford, Kenneth M., et al. "Knowledge acquisition as a constructive modeling activity." International Journal of Intelligent Systems 8.1 (1993): 9-32.
[8] Milton, Nick, David Clarke, and Nigel Shadbolt. "Knowledge engineering and psychology: Towards a closer relationship." International Journal of Human-Computer Studies 64.12 (2006): 1214-1229.
[9] Sieck, Winston R., Louise J. Rasmussen, and Paul Smart. "Cultural network analysis: A cognitive approach to cultural modeling." Network Science for Military Coalition Operations: Information Extraction and Interaction (2010): 237-255.
[10] Johnson, Stephen C. "Hierarchical clustering schemes." Psychometrika 32.3 (1967): 241-254.
[11] Shepard, Roger N. "The analysis of proximities: Multidimensional scaling with an unknown distance function. I." Psychometrika 27.2 (1962): 125-140.
[12] Schvaneveldt, Roger W., Francis T. Durso, and Donald W. Dearholt. "Network structures in proximity data." Psychology of learning and motivation 24 (1989): 249-284.
[13] M.L.G. Shaw, B.R. Gaines, Comparing conceptual structures: consensus, conflict, correspondence and contrast, Knowledge Acquisitition, 1 (1989) 1341-363.
[14] Boose, John H., and Jeffrey M. Bradshaw. "Expertise transfer and complex problems: using AQUINAS as a knowledge-acquisition workbench for knowledge-based systems." International Journal of Man-Machine Studies 26.1 (1987): 3-28.
[15] M.L. Bernard, G.A. Backus, A.B. Bier, Behavioral Influence Assessment (BIA): A multi-scale system to assess dynamic behaviors within groups and societies across time. In Proceedings of the 5th International Conference on Applied Human Factors and Ergonomics AHFE (2014).
[16] Backus, G., Bernard, M., Verzi, S., Asmeret, B., Glickman, M. (2010). Foundations to the unified psycho-cognitive engine. Sandia National Laboratories technical report SAND Report 2010.
[17] M.L. Bernard, G.A. Backus, A.B. Bier, R. Damron, Forecasting attitudinal and behavioral reactions at a societal level. In Modeling Sociocultural Influences On Decision Making: Better Understanding Conflict, Enabling Stability.
[18] Tversky, Amos, and Daniel Kahneman. "Advances in prospect theory: Cumulative representation of uncertainty." Journal of Risk and uncertainty 5.4 (1992): 297-323.
[19] Sterman J. D. (2000). Business dynamics: Systems thinking and modeling for a complex world. New York, NY: Irwin/McGraw-Hill.
[20] Klein, G. A., Orasanu, J., Calderwood, R., & Zsambok, C. E. (Eds.). (1993). Decision making in action: Models and methods. Norwood, NJ: Ablex Publishing Corporation.
[21] Ajzen, I. (1985). From intentions to actions: A theory of planned behavior. In J. Kuhl & J. Beckmann (Eds.), Action control: From cognition to behavior. Berlin, Heidelber, New York: Springer-Verlag.
[22] Perugini, M., Bagozzi, R. P. (2001). The role of desires and anticipated emotions in goal-directed behaviours: Broadening and deepening the theory of planned behaviour, British Journal of Social Psychology, 40, 79-98
[23] Festinger, Leon. A theory of cognitive dissonance. Vol. 2. Stanford university press, 1962.
[24] Meyer, Mary A., and Jane M. Booker. Eliciting and analyzing expert judgment: a practical guide. Vol. 7. SIAM, 2001.