Tree Construction & Criteria Elicitation in MCDM

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This is an initial description of a procedure for discovering Kelly type (1955) constructs for use in Soft Operational Research (O.R.) and Multi Criteria Decision Making (MCDM) projects. Kelly developed the Repertory Grid technique as a quantitative method of implementing his approach. Kelly, however, was mainly interested in psychotherapy, although he was trained as a mathematician and physicist, and practised briefly as an aeronautics engineer. As a psychotherapist he was looking for much more information than we might as decision advisors (DAs). Nevertheless his approach was essentially strong. It was phenomenological, i.e. rooted in the reality of decision maker's mind. Also it was operational, i.e. it produced measures.

The other competitor which we might consider is Grounded Theory (Strauss and Corbin, 1990) which we will not use for similar reasons. It is rooted in sociology and presumes that nothing at all is known of what is being investigated. It, also, requires too much work.

We want a technique that is equally rigorous and yet efficient and workable when dealing with few and many decision makers (DMs), and with big situations and small. Kelly and his followers (see Bannister and Fransella, 1971, Easterby-Smith, Thorpe and Lowe, 1991, Fransella, 1995, and Stewart and Stewart 1981), would very much want that the essentials of Personal Construct theory be followed, not any one particular method of applying it.

One possible applied approach is Eden's Kelly-based method of Cognitive Mapping (Eden, 1988, 1992, Eden and Jones, 1984, Brown, 1992), which was developed for dealing with messy problems in O.R. Once again, the emphasis is more on getting into a lot of detail, in this case as a consensus seeking tool. A possible use of cognitive mapping is that by Richard Ormerod (Ormerod, 1995, Morley and Ormerod, 1996) who uses it both as a problem shaping tool and for later analysis by the DMs. It does appear like a lot of work which would be justified only in large situations and where the interactions of the DMs in implementation requires returning to the cognitive map.

The procedure described below attempts to encapsulate a workable approach. It is based on a logic to do with qualitative decision making (Brugha, 1998a, 1998b, 1998c).

A.   If it is an adjustment problem (Brugha, 1998b) use the Priority Pin-Pointing Procedure (Brugha, 1998d).

D.   Otherwise it is a development problem (Brugha, 1998c) in which case use an approach based on exploring alternative choices (Brugha, 1998e) which is described in more detail here.

1. Constructive elicitation of factors:- Ask the respondent:
   (a) "What are your alternatives?"
   (b) "How do you differentiate them?" Then:
   (c) Structure them in a Nomological Tree.
   (d) Repeat and extend processes (a), (b) and (c) to exhaustion using the understanding indicated by the tree, in particular exploring the gaps in the tree, moving out from the obvious alternatives to the less obvious ones, including hypothetical or desired alternatives by asking questions including "should" and "like" words.

2. Combine the trees for multiple respondents, if necessary returning to some of them for clarification.

3. Constructive weighting of alternatives at the end nodes on the tree.
   (a) Work "bottom-up" scoring each individual on the alternatives on the lower level attributes (which correspond to criteria).
   (b) Rate factors (criteria) relative to each other on the tree.
   (c) Give feed-back to the decision maker all the way up the tree, allowing for the "out-ranking" and consequent exclusion of poor alternatives.

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4. Check that each DMs synthesised choice matches their indicated preference, in whatever way they gave it: initial ranking, fuzzy preference, etc., and carry out consistency checks. Where there seems to be a problem, revisit it and ask the DM to reconsider. Be transparent about it. The only "perfect answer" is the DM's; but if there are quite inconsistent or confused this may be a tree problem, a definition problem, whatever. It may be necessary to not work with a synthesised tree if there are genuinely distinct groups of DMs who act differently. If necessary segment the DMs.

5. Synthesise the choice procedure for all the DMs noting:
   (a)   Actual choices made.
   (b)   Relating these to the DMs background.
   (c)   Structure these within the tree.
   (d)   Do these processes (a), (b) and (c) to for subsets of DMs gathering clusters of similarly deciding groups.
   (e)   For each subgroup get average scores of alternatives on attributes.
   (f)   For each subgroup get thresholds at which alternatives are outranked.

6. Summarise and report noting areas of sensitivity, relating them to tree structure, tree weights, scores on attributes, segmentation issues.

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