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Strategic Correspondences: Computer-aided Insight Scaffolding

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Building on the arguments of earlier papers, this paper advocates the use of centro-symmetric diagrams, controlled through suitable graphics software, to hold and re-configure concept sets — whether user initiated or supported by a library of such sets. It is emphasized that computer software features have evolved to such a high degree that it is worthwhile challenging any new approach to knowledge organization with the question: "what could that software feature offer to knowledge organization?". Often the software already available offers facilities superior to the needs articulated or envisaged by those concerned with knowledge organization. (Author)

1. Introduction

This note builds on the arguments of several earlier papers (1, 2, 3, 4 and 5) but especially *Envisaging the Art of Navigating Conceptual Complexity: in search of software combining artistic and conceptual insights* (6). The emphasis here is on the use of centro-symmetric diagrams, especially those based on subdivision of concentric circles, to hold and reconfigure concept sets.

There are many knowledge tools based on ordering disparate elements for access by keyword, thesaurus or other clusters. These have proved useful to retrieve specific documents in particular subject areas. However they do not assist in configuring whole patterns of knowledge and insight. This is exemplified by the incredibly simplistic menu systems available on Internet and the World Wide Web for access to documents by subject. Compared to the sophistication of the technology used — and the non-linear approaches of hypertext linking — these knowledge tools reflect asystemic patterns of thinking of an earlier era. The design of search engines and know-bots to retrieve information from the Internet does not address the challenge of how intersectoral, cross-category, transdisciplinary information is to be configured for comprehension.

The software explored below emphasizes what might be called a top-down approach in which a global, systemic, or "holistic" configuration is always retained. It is sensitive to the individual's mnemonic needs for a memorable configuration of topics which can act as scaffolding for larger and subtler insights. There is also a concern to manage information overload by adjusting the display in response to changing tolerance for complexity in a learning environment. At a time of ever increasing social and knowledge fragmentation, such tools merit exploration — as a possible support for more coherent individual action and more integrative collective policy-making.

2. Design approach

Computer software features have evolved to such a high degree that it is worthwhile challenging any new approach to knowledge organization with the question: "what could that software feature offer to knowledge organization?". This is in contrast to the question "what software features might be used for a preferred approach to knowledge organization?". It should be recognized that often the software already available offers facilities superior to the needs articulated by those concerned with knowledge organization.

The intent here is not to over-specify a desirable knowledge organization tool, but rather to indicate how some features might be useful if appropriately adapted to the needs of knowledge organization. The intention is to evoke speculation on possibilities of knowledge organization rather than to seek premature closure — especially when such closure may need to be in the hands of the end user. This allows the question: "to what extent should the end user be offered knowledge (re)organization facilities?" This is in contrast to the assumption that "these are the knowledge organization tools which are appropriate to the end-user".

3. Knowledge organization facilities

(a) Clustering

Consider a simple situation represented by two concentric circles displayed on a computer screen. By clicking on the centre circle, the user is able to type in a topic category (or browse through a category list and select one). As the simplest example, if the user selected "day", this would result in the outer circle being subdivided by seven radials, with a day of the week (Monday, Tuesday, etc) presented in each of them. Clicking on any one of these could then result in relevant information being displayed. (Note "category" is used here in the loose manner in which it is now used on the World Wide Web as a "basket" or "bucket" for subjects, topics or concepts).

Now consider a more sophisticated variant using information from cultures that group days in other ways. Selecting "day" would then result in a subdivision of the

outer circle into the number of such different systems (say 3, 5, 7, 10 and 28-day groupings, namely 5 alternative categories in all). Selecting one of these (which would then be highlighted in a contrasting colour) could then result in the addition of a third concentric circle, subdivided according to the number of items characteristic of that system, with each subdivision named accordingly. The user could select any one of the other categories in the second circle, and have the corresponding sub-categories displayed in the third.

To complete the information, a tabular list outside the concentric display could indicate the name of the category cluster associated with each circle as a whole. For example: 0-circle = day; 1-circle = week, etc. Clicking on "week" in this list could offer the possibility of selecting "month" as a broader category. This could be used to trigger the display of a concentric circle of 12 months. Continuing the process, clicking on "year" in the tabular list could result in a display of centuries, or other historical or geological eras.

(b) Subdivision

Similar facilities could be offered for category subdivision. Related possibilities include the ability to click on a particular circle subdivision and have displayed in a popup checklist the narrower subcategories into which that category is subdivided. The user could then choose to have these added as a concentric circle in the display. Alternatively they might be displayed permanently in the subdivision instead of in a popup — with the possibility of collapsing that display whenever required (as is done in many text outliners).

(c) Reconfiguration

At any time the user has the possibility of selecting any displayed category and moving ("dragging") it to the centre of the circle (or to the top of the tabular list) and reinitiating the display from a new anchor point.

Of special conceptual interest are those situations in which broader or more integrative categories are absent. In this case the central circle is necessarily empty. The next circle may then contain whatever is considered a complete system of categories. It may be a user preference as to whether the major subject categories used by libraries (such as in the UDC system) are distributed in a circle of 9 or 10 subdivisions around an empty central circle, or whether the empty centre is satisfactorily named by "generalities" or "organization of knowledge". It is worth noting that in a number of Eastern epistemologies, the emptiness of the central circle is of prime significance.

The previous paragraph highlights the possibility of offering the user the ability to subdivide categories. Thus a decision might be made to split the fourth of a set of 8 categories, making a set of nine. Or it might be decided to join the fourth and the seventh, making a set of 7. If these correspond to operations on officially recognized systems of categories, the user presumably also needs the facility to be able to revert to the official version, even if such experimental reconfigurations are saved and used for an extended period of time.

(d) Rotating the display

The centro-symmetric display provides structural emphasis to integration. It can however be difficult to read if the information has to be presented radially. Of great interest therefore is the possibility of redesigning the usual scrolling facility in order to rotate the circles as much as is required.

This suggests a further use of such a display to browse and locate a subject or other item in very long lists. Some computer menus already respond to this challenge by presenting the letters of the alphabet in a list so that one may be selected as the entry point to a browseable list. In a circular display, such letters could be presented around a circle. Clicking on one could result in a second circle being displayed. In this circle the items would however be positioned according to the second letter — possibly with only the first item presented in each subdivision of the circle. Further clicking could result in the display of further circles based on third and fourth letters.

At some point the user could choose to browse the contents of a particular subdivision. Whether in a popup or by using the subdivision as a window on a list of items that are moved past it. The whole procedure amounts to "dialling a subject", with the advantage that a sense of context is maintained.

(e) Access functions

As the previous paragraphs suggest, such software could be used for very simple purposes. It provides an alternative to linear approaches to long browse lists or multi-level category hierarchies. It remains to be discovered who would find this approach preferable, if only as an option, and under what circumstances.

Having used the software to configure a pattern of categories, the question remains as to what else might be offered. Selecting a particular category, the user could then be offered a menu of possibilities. These might include:

- display of text (including address information);
- display of iconography or graphics;
- hyperlink to another location, possibly on the World Wide Web
- execution of some computer program.

The information might be supplied as part of a proprietary package (such as an encyclopedia), an institutional database, or developed by the user. In particular the user might be free to supply, and or amend text.

4. Applications suggesting other possibilities

(a) Strategic responses to complex systems

Major international conferences are frequently convened in response to complex systems of problems. The

intention is often to develop a strategic plan to coordinate collective response. Such initiatives are severely handicapped by the preferred output format, namely a checklist of strategic categories and sub-categories, which usually ignore the systemic links between the issues on which action is planned. The best example is *Agenda 21*, resulting from the UN Conference on Environment and Development (Rio de Janeiro, 1992) which clusters some 2,000 strategies into a strategic framework lacking any systemic linkages and constituted a special challenge to concept organization (5).

The conceptual organization of such initiatives is of course severely affected by political pressures and compromises. Fashionable flavour-of-the-month categories are stressed, and media-challenged, politically controversial, or minority-interest topics are suppressed. The result is a macro-organization of the strategic framework into "chapters" (Agenda 21), "baskets" (Conference on Security and Cooperation in Europe), "initiatives" or "points". There is often little systemic basis for the pattern of macro-organization.

Because of the manner in which the items are debated, even within "chapters", with a line-by-line examination of items that must often be temporarily "bracketed", links between items within or between chapters is beyond the scope of the conference discussion. It could be argued that this is in large part due to the linear nature of the presentation of the information and the lack of any conceptual scaffolding for a non-linear relationship between items. Political debate is considered complex enough without having to worry about the systemic links between the areas under discussion. Unfortunately it is precisely this attitude which renders the resulting strategies unsustainable and leads to unforeseen consequences when they are implemented. Despite the much-acclaimed need for new approaches to governance, especially at the world level, little attention has been given to the forms of knowledge organization that might be needed to support it. A tragic example recently, highlighted in the media, is the inability of the European Union to distinguish between a "tin of beans" and a "pig" as a living entity — both being categorized as "agricultural products". The OECD Macrothesaurus was long challenged by inability to distinguish the environmental role of fish from the economic activity of fishing.

With the kind of software advocated here, there is an opportunity to handle and display complex systemic linkages without the difficulties of information overload. Consider a situation in which a complex strategic situation is under discussion. Tentatively seven (say) main areas are identified. These are then used as subdivisions of a circle around an empty centre. There is now a need to check the completeness of this set. Database information on previous approaches using such categories can be drawn upon. What is required is computer feedback on instances where the seven were completed by one or more further categories. These would be instances which would see the 7-fold division as incomplete. This allows for debate on the significance of any omitted categories. A similar approach can be taken to instances where six or fewer categories were used, because it was considered appropriate to merge one or more of the seven identified. This procedure tests the goodness of fit of the pattern of knowledge organization chosen. It builds on the experience of the past whilst allowing for creativity in the present.

In either of the above cases, the alternatives can be displayed as extra concentric circles. The advantage of this is that clicking on any of the category subdivisions displayed provides information on what was included under that category label. Thus "health" in one system may be restricted to human physical health, whereas in another it may include psychological dimensions of health. Elsewhere it may even include non-human health.

This process of firming up the set of categories can be assisted by other facilities. From a systemic perspective, the problems perceptible through any category can be seen as linked together in chains and loops making up problem webs. These links can also be held in a database. Considering only the 7 (say) major categories of the envisaged strategic initiative, those links between problems across the boundaries of these categories could then be displayed as an overlay of coloured straight lines across the circles. Features such as thickness of line could be related to the number of such links in each case. Users could then click on any line to view a list of problem pairs (say) systemically linked between any two categories. Moving any problem (or the corresponding strategic response) from one category subdivision to another, then effectively changes the definition of both sub-categories. It will also adjust the pattern (or thickness) of lines between the sub-categories. This facility may also be used to test alternative (or past) approaches.

It is worth noting that each government, with its pattern of ministries and portfolios, can be represented and compared using such software. In each case a government aspires to deal with the whole of society. In one case this may be done with a handful of ministries. In another these concerns may be articulated through dozens. "Environment" in one case may be very different from "environment" in another. It may even be appropriate to use concentric circles to display a historical sequence of patterns of ministerial organization, as a way of understanding systemic pressures on governance and the consequences for official knowledge organization. It is also worth noting that communication links between ministries can usefully be designed to reflect the systemic linkages between the problems with which they are concerned — and where such communications are weak or absent, strategic action by government is bound to fail.

Whilst the points above focus on the macro-organization of a strategic approach, similar questions must necessarily be raised regarding the micro-organization within any of the categories in a circle. The software may be used to explore this by moving any particular category to the 0-circle level in the tabular list and forcing its own

sub-categories to be presented as subdivisions of the 1-level circle. Again the systemic links between categories can be overlaid. And again items can be moved from one subdivision to another if this seems to be appropriate.

What then are the consequences for the formulation of global strategic plans?:

- Questions as to whether particular issue categories should be included or excluded then become clearer, whatever games are played with labelling categories to seek short-term political advantage. There is even merit in allowing for an extra "shadow" category in any circular display to hold implicitly or explicitly excluded items. The user may have the option of hiding this shadow subdivision or having it displayed as a reminder of unresolved issues. Displaying it may be especially interesting if there are significant systemic links to it.
- If used as a real time display to track the course of a conference debate, the software can be used to reflect categories opened up by speakers and relationships made between those categories (with the further possibility of holding commentary in corresponding database records). The question of whether a contribution is "to the point" or "on track" then has graphical consequences. New tracks opened up (perhaps as new circles) may be declared out of order. Such displays then serve as time-binding devices in that they provide graphic bridges between the contributions of a succession of speakers covering a range of points. In a real sense they provide conceptual scaffolding for conferences vulnerable to destabilizing contributions and speakers.
- Debate on issues is sensitized by the presence of information on systemic links between issues. Distinctions can be made between collectively acknowledged links and those deemed questionable. The debate on any such distinctions can be conducted with greater conceptual discipline. However the software can be used to selectively suppress information where it may cause overload and may be counter-productive to the momentum of the debate.
- Text (and graphics) on strategic initiatives at any level are held in a systemic framework. Such information may be accessed and amended (possibly only following a formal collective decision) at any time. Alternative proposals and wordings may also be held in such a way that their systemic implications are apparent. The product of the conference is therefore far more than a linear text. It is effectively an annotated systemic framework which can be explored according to the user's tolerance for complexity. Because the systemic links are present, and items of detail can be held without confusing the text at a more general level, such a product is effectively configured for implementation. Legal, management, educational and public relations text variants can be held in relation to the same framework.
- Because comparison with alternative or past strategies may be readily made, the strengths of the strategy may be readily seen. The definitional challenges and possibilities of misinterpretation can be specifically addressed.
- In a multi-lingual or multi-cultural environment, such software facilitates management of alternative wordings. This can be especially important when category subdivisions possible in one language are not meaningfully distinguished in another (whether because for a given issue more subcategory distinctions are usually made, or fewer, due to a lack of equivalent terms). Clarifying differences in category breakdowns may then be conducted in a more conceptually disciplined manner rather than in the current ad hoc manner that disguises confusion that emerges only on implementation.
- Conventional listings of themes easily disguise the fact that they may well contain features that are strategically incommensurable or constitute strategic dilemmas (e.g. simultaneously striving to promote industrial growth and environmental conservation). Identifying and working with such dilemmas is the responsibility of any conference of wider significance. The software may then be used to juxtaposition the subcategories that are strategically "incommensurable" — configuring them so that debate is not trapped into unfruitful polarized discussion of complex questions of checks and balances. The software may be used to give graphical representation to such checks and balances.
- The software effectively provides for the management of future amendments and the comparison between a strategy at different stages in its evolution. One example is the manner in which the UN Environment Programme was forced to reconfigure the pattern of its environmental concerns over time, changing the number of sectors into which "environment" was subdivided.

(b) Comparison between complementary systems of categories

The software could also be used to hold information of different types. This is valuable where these have some relationship to each other. Examples include:

- Use of concentric rings to hold information on world problems, action strategies, human values, international organizations, international meetings, and understandings of human development. This is the challenge of the data currently published by the Union of International Associations in the *Encyclopedia of World Problems and Human Potential* (7), its companion *Yearbook of International Organizations* (8) and the *International Congress Calendar*. Each circle could be subdivided into categories selected as equivalent. "Zooming" features could be envisaged to equivalent displays at the subcategory level.

- Concentric rings could be used to hold different types of qualifiers on a set of concerns represented by subdivisions of an inner circle. Separate circles could thus be used for geographical, chronological, urgency/priority, cost/resource, feasibility, or other qualifiers relevant to strategic initiatives. As a retrieval device, for example, linking one subdivision from each circle to a particular issue would fruitfully focus a search profile. As before, it is a way of formulating a database search request through "dialling" a profile. The request could possibly be passed through to an Internet search engine.

(c) Self-organization and self-coordination of groups

There have been occasional creative attempts to use centro-symmetric organization charts. A sophisticated software package (*Netmap*) uses a centro-symmetric display to interactively reconfigure displays of large numbers of transactions between clusters of organizations, departments or individuals (notably as a means of identifying fraud). The cybernetician Stafford Beer has also moved a long way in exploring the possibility of centro-symmetric team building supported by appropriate electronic communication protocols (9). Idea mapping tools, such as the *Mind Mapping* package (10), can be viewed as centro-symmetric, as can some exercises in mapping hypertext (11). However the software proposed here suggests other possibilities in support of the process by which groupings of individuals (or organizational units) emerge and collaborate at an appropriate level of integration (especially across incommensurable issue divides):

- Consider the case of non-interacting individuals (or groups), whether represented at a (large) meeting or in a conference on Internet. Using software of this kind, each can develop (for themselves on their own display) a profile of interests as category subdivisions around one or more circles through which they wish to order their communications. This provides a more sophisticated framework for a frequent requirement that participants profile their interests ("with a few keywords") for a participant directory — an exercise often experienced as simplistic, if not insulting, to those with a complex pattern of interests. Using the database resources for comparative purposes, the software can now be used to negotiate labels for categories amongst those using equivalent terms. The negotiation process may simply result in the ability to display in a circle the range of variant usages of a given term in the light of the subcategories it subsumes for a particular user. A further step might be to harmonize understanding to some degree. In some contexts this may result in agreement (or imposition by a central authority) of a particular understanding. This could be a dynamic process throughout the period of interaction of the individuals, with the significance of categories constantly subject to challenge.
- The above process, having clarified terms, allows for a degree of matching between those with particular combinations of profiles. Such matching is a basis for the emergence of groups and communities of discourse. These can be essential in order to select in and filter out messages to avoid overload. The process may also be vital as a means of unpacking the significance variously attached to portmanteau terms like "peace", "sustainability", "development", "family values" and the like, as a prelude to meaningful action.
- Consider the situation with a collaborating cluster of individuals (or groups). In contrast to the conventional approach of "groupware" packages, the proposed software does not focus on management of commitments and schedules of group members. Rather the focus is maintaining an overview of configurations of often incommensurable concerns, and the ability of those involved to respond to them. The challenge of the software is to provide conceptual scaffolding to facilitate the emergence of coalitions of actors that would be completely unstable, or impossible, under other circumstances — the strategic challenge is no longer single-issue programmes, but incompatible-issue programmes. The software is therefore used to configure the pattern of these issues around one or more circles. But those participating will each tend to have particular interests or responsibilities. Clicking on a given category and moving it to the centre then allows for the presentation of a reconfigured display corresponding to the more active or immediate interests of certain participants. For multi-level organizations with "global" concerns, this may be repeated to capture and reflect more sharply particular "local" concerns. Note how the software facilitates movement ("zooming") between different strategic levels — offering access to the perspective of each so as to honour its priorities, whilst integrating it within a broader conceptual framework. Any such grouping is therefore held together by the software facility — to the extent that this provides pathways through which transformations of perspective between the local and global clusterings of categories with which participants are concerned in different ways.

The facilities offered by such groupware packages as GroupSystems (developed at the University of Arizona) offer "categorizer" facilities which allow users working through different workstations to create a variety of lists and put the results into "category buckets". Another decision support package, COPE (developed by the University of Strathclyde), allows ideas (termed concepts) and links formulated during a meeting to be captured and structured in map form so they can be manipulated, explored and analyzed. It can be used to handle hundreds of concepts.

(d) Relationships between physical, chemical or other variables

It is usual to treat combinations of categories as potential keywords for information retrieval. In the sciences,

but also in culture (see below), categories often have relationships to each other of major significance. This is especially the case with physical and chemical equations.

- Consider, as an example, the "pressure", "volume" and "temperature" of gases. Using the software, the user could position each of these in subdivisions around a circle. The user could then use a facility to query for any relationship. The response could be given in the centre of the circle in the form of the standard equation relating them. Multiple responses could be positioned in subdivisions in an outer circle.
- In the case of chemistry, reactants could be positioned in subdivisions around one circle. The user could then query for the consequences of their reaction and have the results positioned in one or more outer circles.

(c) Exploration of cultural and religious symbolism

Much cultural and religious symbolism is concerned with sets of symbols. Each set provides the context for the emergence of a larger or subtler insight — which may often require lengthy study, experience or meditation to grasp. Whether this is considered as classical education, psychotherapeutic integration or spiritual development, during this process users may want recourse to graphic, textual and even an anecdotal or aphoristic information. There is therefore a strong case for using the software to position the symbols in subdivisions around a circle so that appropriate forms of information can be required — and so that particular sets of symbols may be compared with others.

- Such concentric circular displays were in fact a characteristic of the renaissance period, whether used to hold arrays of Christian saints, principles, or other symbols. They were often used in exploring "correspondences" in the light of the hermetic principle "as above, so below".
- Eastern religious and philosophical systems have made extensive use of concentric displays, notably in the form of various types of mandala. Very complex displays were, and are, used for geomantic mapping purposes. It is probable that Asian countries with powerful computer skills will devote resources to displays of this kind, irrespective of Western views on their relevance.

5. Further possibilities

It is important to note Maruyama's (12) caution that the assumption that reality can be subdivided into non-overlapping categories is typically western. His work has identified other, hopefully complementary, approaches. Such insights are important to interparadigmatic dialogue, as stressed by Kinhide Mushakoji (13).

The question is how to use the software to allow for fuzzy categories, and overlapping categories. Presentations of colour palettes in existing software, some in circular form, are an indication of how boundaries can be blurred whilst allowing distinctions to be made. More work is required on non-western category displays and their implications for knowledge organization if there are to be any meaningful claims concerning universal knowledge organization.

6. Conclusion

There is a major need for knowledge organization tools that enable the user to configure patterns of information beyond the limitations of nested list structures and table formats. There is a need for forms of knowledge organization that are tentative and open to challenge and renegotiation in group and learning environments — whilst providing access to a variety of authoritative orderings, if required for comparative purposes.

The many intriguing possibilities of the World Wide Web, image-mapping techniques, and the new Java applications, will suggest fruitful new approaches to knowledge organization in a graphics environment — especially in relation to electronic meetings where knowledge organization concerns have remained relatively simplistic (14). At this point the technology is ahead of understanding of its relevance to knowledge organization. It is interesting that software developments are themselves triggered by new "metaphors" — an issue raised in other papers (15, 16, 17)

Focusing on how existing software techniques might assist new approaches to knowledge organization provides a way of envisaging new possibilities. Focusing on knowledge organization needs in a conceptually fragmented society is another. Both of these are in contrast to conventional tendencies to define a new system of knowledge organization and to then seek to promote its widespread use — often without envisaging future needs of users to modify it in the light of their experience or circumstances. This can be considered a form of conceptual imperialism, rightly challenged by the conceptual anarchy on the Internet. More however is required.

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