Harnessing collective wisdom at a fraction of the time using Structured Dialogic Design Process embedded within a virtual communication context

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Abstract: This paper describes the application of Structured Design Process (SDDP) within the context of a rich web-based communication environment. Using a combination of asynchronous and synchronous communication tools for engaging stakeholders at different places in a disciplined dialogue, the authors evaluate the extent to which the SDDP can be applied to deliver reasonable and useful results at a shorter time and at a lower cost to the participants and the sponsors of the dialogue. This new "technology of democracy" is based on the experience acquired from four virtual co-laboratories, during which different components of the revised SDDP methodology were tested. The paper focuses primarily on the synchronous interaction of the participants and the roles and technologies required in facilitating their disciplined dialogue in the production of a Root Cause Map.

Keywords: Collective wisdom; Cyprus; peace; Structured Design Process; democracy; Interactive Management; dialogue; social system design; agora; Skype; Claripoint; stakeholders.

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Biographical notes: Yiannis Laouris is a medical graduate of the Leipzig University, Germany where he also completed a PhD in Neurophysiology with systems physiologist P. Schwartze. Next, he joined cyberneticians Henatsch and Windhorst at the University of Goettingen. He later earned an MS in Systems and Industrial Engineering from the University of Arizona where, as Research Assistant Professor at the Department of Physiology, together with D.G. Stuart he applied linear and non-linear analysis to study peripheral brain signals. He is now Senior Scientist at the Cyprus Neuroscience & Technology Institute. He leads the New Media in Learning Lab and his research focuses on the marriage of technology and learning. During the past 15 years he has been actively involved in an island-wide experiment to transform the educational system and in the Cyprus peace movement. He applied systems science and SDDP extensively to support agents of change in both domains. He has published more than 30 articles in journals such as *Neuroscience, Journal of Neurophysiology, Experimental Brain Research, Behavioral and Brain Sciences, World Futures.*

Aleco Christakis, Ph.D. has 35 years of experience in developing and testing methods for engaging stakeholders in productive dialogue. He is author of over 100 papers on stakeholder participation. Recently, he published the book *How People Harness their Collective Wisdom and Power to Create the Future* (2006), which brings the science of structured dialogue closer to international users. He is Past President of the International Society for the Systems Sciences (2002), President of the Institute for 21st Century Agoras, Member of the Board of the Americans for Indian Opportunity (AIO) and Advisor to the AIO, and an advisor in the *Ambassadors* leadership program for engaging tribal leaders from the USA and internationally.

1 Introduction

The Structured Dialogic Design Process (SDDP) is a deeply-reasoned, rigorously-validated methodology for dialogic design, which integrates knowledge from mixed participants in strategic design settings. It is especially effective in resolving multiple conflicts of purpose and values, and in generating consensus on organizational and inter-organizational strategy. It encourages innovation and prevents "spreadthink" and "groupthink" (Warfield, 1993). SDDP efficiently enables democratic redesign of socio-organizational systems and practices based upon a dialogic process that consolidates power relationships into consensus agreement for effective cross-functional collaborative action. The SDDP is scientifically grounded on six laws of cybernetics recognized by the names of their originators: Ashby's Law of *Requisite Variety* (Ashby, 1958); Miller's Law of *Requisite Parsimony* (Miller, 1956; Warfield, 1988); Boulding's Law of *Requisite Saliency* (Boulding, 1966); Peirce's Law of *Requisite Meaning* (Turrisi, 1997); Tsivacou's Law of *Requisite Autonomy in Decision* (Tsivacou, 1997); and Dye's Law of the *Requisite Evolution of Observations* (Dye et al., 1999). In the discussion section, we reflect on how the proposed model might expand the applicability of some of these laws.

The need for such a scientific methodology to facilitate democratic dialogue was first envisioned by systems thinkers in the Club of Rome (Ozbekhan, 1969, 1970). It was systematically refined through years of deployment in Interactive Management (IM), to emerge as methodically grounded dialogue practice that now is supported by software specifically designed for the purpose. IM, originally developed by John Warfield and Aleco Christakis in the early 1970's (Christakis, 1973; Warfield & Cardenas, 1994), has evolved into its third generation as SDDP. IM has been successfully applied hundreds of times in businesses, governments, NGOs, and international organizations. In almost all occasions IM and SDDP have been applied in the context of co-laboratories where all participants are physically present. The duration of a typical co-laboratory ranges from a minimum of 10-20 hours to over 100 hours. The purpose of the work reported in this paper was to investigate the extent to which the SDDP can be applied to deliver reasonable and useful results at a shorter time and at a lower cost to the participants and the sponsors of the dialogue exploiting virtual communications technologies.

1.1 Contemporary applications of technology to support inter-group dialogue

In recent years we have witnessed an orchestrated effort of the European Union, the UN and many developed countries to introduce information technology (IT) and new technologies as tools to accelerate development. Just before the explosion of IT in 1997, UN General Secretary Kofi Annan supported this global campaign with his statement that "Recent developments in the fields of communications and IT are indeed revolutionary in nature. Information and knowledge are expanding in quantity and accessibility. In many fields decision makers will be presented with unprecedented new tools for development. … the consequences could be really quite revolutionary. Communications and IT have enormous potential, especially for developing countries…" During the last decade, the European Commission has provided massive funding for projects that introduce IT not only in industrial, academic and research arenas, but also in governmental services, in decision making processes, and in general projects that aim to increase communication between stakeholders and increase access to information, products, and services. Yet, there are still not enough examples of initiatives that directly address the issue of how a diverse group of stakeholders can engage in a democratic and structured dialogue, reach a consensus and take actions. The first author published a recent review of how IT can and must be exploited in the service of peace and development (Laouris & Laouri, 2007).

The Seeds of Peace (www.seedsofpeace.org) founded in 1993, use state-of-the-art technology to enable teenagers across borders engage in democratic dialogue within their SeedsNet secure listserv. The project aims to empower young leaders from regions of conflict with leadership skills. Through its well-structured forums, it supports dialogue during periods of unrest, thus contributing towards reconciliation and coexistence. The network now encompasses over 2,500 young people from four conflict regions. Another example of a system that facilitates global debates was created by The Watson Institute. It's Information Technology, War, and Peace Project (www.InfoPeace.org) was created to track and analyze IT's influence on new forms of networked global politics. InfoTechWarPeace challenges the traditional discourse on world order, which is defined by state-centric, realist interpretations of power. However, in the past decade and especially after September 11, very different global actors have emerged ranging from fundamentalist terrorists to peace activists, who gain advantage exploiting the broad bandwidth of IT. The Project investigates how these individuals and groups make use of IT to influence world politics. InfoTechWarPeace aspires to produce, through rapid internet interventions, online forums, international symposia, video-teleconferences, and documentaries, the kind of networked knowledge, critical thinking, and ethical sensibility that will help raise public awareness and inform new policies on global technological issues in war and peace.

The third example documented here emerged out of the Cyprus communication paradox. As so elegantly stated by Gumpert and Drucker (1997), “Cyprus is a communication laboratory and an anomaly. It is a country globally connected, but locally and interpersonally divided. It is a land divided by bricks, concrete, barbered wire and other barriers of all shapes and forms that compose the Green Line.” This “communication anomaly[1]” challenged peace builders to envision innovative uses of technology. IT has been exploited in peace building activities in Cyprus in at least two distinct levels: (1) to break the communication barrier between the two geographically isolated communities of Turkish and Greek Cypriots, and (2) to facilitate the creation of a shared vision and a concrete strategy toward achieving this vision. In 1998, through a USAID-, followed by a USIP grant, which were granted to Dr. Hrach Gregorian, President of the IWA (Institute of World Affairs) working together with Cypriot peace builders[2] the tech4peace initiative was launched. The project supported a series of virtual negotiation co-laboratories (Laouris & Tziapouras, 2002) using a model developed at the University of Maryland. Participants from the two sides of Cyprus were engaged in negotiation exercises using virtual communication tools, without ever meeting physically. This project served as a predecessor of the tech4peace portal (www.tech4peace.org), which was originally created with UN funding to support peace builders and NGOs in their peace building efforts. The portal, which hosts today more than 5,000 pages and enjoys more than 40,000 monthly hits, has probably become one of the largest peace portals in the region.

The next section expands on a unique application of SDDP, which facilitated the creation of an island-wide peace movement.

1.2 Focusing on Cyprus

For nine months, between the fall of 1994 and the summer of 1995, a core group of thirty-two Greek Cypriot (GC) and Turkish Cypriot (TC) conflict resolution trainers and project leaders used IM to envision and design peace-building activities in Cyprus. The group met on a weekly basis, and occasionally on weekends, both in separate community meetings[3] and in bi-communal settings. During the first phase, each community applied IM separately to identify the obstacles to their work and to structure these into a *problematique*, i.e., system of problems, surrounding the peace-building process in Cyprus. Their structured dialogue was supported by a forerunner of Cogniscope developed at the George Mason University. Fulbright scholar Benjamin Broome facilitated their co-laboratories and trained the first IM trainers. In the second phase, peace builders, again working in separate community groups, constructed *vision statements* for their peace-

[1] Following the tragic events of 1974, the Turkish military banned all crossings of the cease fire zone.

[2] Yiannis Laouris and Harry Anastasiou in the South and Bekir and Fatman Azgin, Dervis Besimler and Mustafa Anlar in the North. More at: http://www.tech4peace.org/nqcontent.cfm?a_id=476

[3] Between 1995 and 1997, the strong intervention of international diplomats furnished Cypriot peace pioneers with special permission to cross the Green Line.

building efforts. Subsequently, when special permissions enabled them to meet physically, they came together in a bi-communal setting to construct a collective vision statement. In the final phase, during which all sessions were bi-communal, Cypriot peace pioneers came up with a total of 241 possible projects designed to support their vision and selected 15 of these projects for implementation. During the following two years some of these peace pioneers, who were trained as IM Facilitators, applied the SDDP methodology in week-long co-laboratories to create more than 25 bi-communal groups (For reports see Hadjipavlou-Trigeorgis, 1993; Broome 1998; Wolleh, 2001; Laouris, 2004; A historical map of all groups created can be accessed on line[4]). Approximately 1,500 individuals, including the Young Business Leaders, the Internet Group, Young Leaders, Women's Group, Citizens' Group, Management Group, Educators' Group, University Students' Group, Youth Promoting Peace Group, and several others emerged out of these co-laboratories. As groups shared their maps, they were surprised to find astonishing resemblance across maps created by different groups. A robust sense of community emerged that generated momentum towards the formation of a Peace Movement. The comprehensive obstacles-, visions- and option maps produced during these and follow-up co-laboratories were subsequently used by the UN to develop the first-ever comprehensive plan for a solution to the Cyprus problem. Selected peace builders served as informal UN advisors during the preparation of various versions of the UN Peace Plan, which became known as the Annan Plan.

In sum, IM and SDDP played a major role in supporting peace builders in Cyprus, initiate bi-communal contacts, create a culture of peace, plant the seeds for a peace movement and feed the UN with ideas that eventually culminated to the Annan Plan. The UN Plan was put to separate referenda in 2004 and unfortunately did not make it. Peace builders believe that one of the many reasons for its failure lies in the small number of people who had the chance to participate in a well-structured peace dialogue as enabled by SDDP. This deprived them the opportunity to gain deeper understanding of the political situation, engage in constructive dialogue, thus becoming capable to evaluate options and trade-offs critically. Based on this experience, it became apparent that a major shortcoming of the SDDP methodology lies in the fact that it requires great investment in personal time and long-term commitment in order to achieve desirable results. It is within this context that the effort to reduce the time and cost required for achieving desirable results was initiated with the intention of ameliorating this shortcoming of SDDP. Thus, the purpose of our initiative was to re-design the SDDP methodology taking full advantage of latest information and telecommunication technologies. The goals included: (a) to make possible the participation of remote participants located at different places, (b) to break the process in smaller synchronous and asynchronous chunks of time, thus making it more manageable and accessible to the diversity of stakeholders required for disciplined dialogue on complex issues, and (c) to significantly shorten the time and lower the cost required for achieving reasonable results in terms of diagnosis and agreement on a collaborative action plan.

2 The four co-laboratories that lead to the development of the new model

The model was applied partially in four different occasions. First, it was used in the context of an IM co-laboratory that was organized for a group of European scientists

[4] http://www.cnti.org.cy/TFP_Album/Posters/slides/BicomHistoryMap97.html

specialized in broadband technologies (Ayia Napa, Cyprus; 7 October 2005; Laouris & Michaelides, 2007). The purpose of the co-laboratory was to develop a shared understanding regarding the obstacles that prevent the exploitation of broadband technologies and to build commitment within the COST 219ter[5] community to an action agenda for collaboratively addressing the problem. The typical application of the SDDP was modified in the following ways:

1. The triggering question was formulated one month before the co-laboratory and was sent by email to all participants. The purpose was to stimulate the participants' creativity and encourage them to begin generating their ideas before the actual meeting. It also served to reduce the time required to explain the methodology at the onset of the co-laboratory. The *triggering question* was: "*Considering the availability of powerful broadband technologies and the development of relevant scenarios, what are the obstacles that prevent us from producing practical applications?*"
2. During the weeks following the formulation of the triggering question and until the day just before the first co-laboratory, participants were allowed to forward their ideas, accompanied with 3-4 lines of clarifications, by email sent to the authors. Sixty-four ideas (i.e., factors) were generated.
3. All ideas were recorded by the authors, entered into the Cogniscope program and a compilation mailed back to all participants before the actual co-laboratory.
4. During the first hour of the physical co-laboratory, participants were given the opportunity to review again all factors produced, request clarifications and contribute new ideas.
5. During the break, a group of four knowledgeable individuals was assigned the task to cluster the 64 factors, thus saving group time.

The application of the above modifications was successful in reducing the time needed at the onset of the co-laboratory, in terms of introducing the methodology and generating the ideas, to less than one hour. However, it was still not possible to complete the task during the 3.5 hours foreseen for this co-laboratory. During a follow-up co-laboratory in Spain (7-8 March, 2006), which lasted for 6 hours (spread over two days) the SDDP produced a Root Cause Map (RCM) that left all participants quite satisfied. One factor invariably "sank" at the foot of the RCM making it stand out as the most influential: *The difficulty of the 'handicap' community to agree on and to define what accessible products and services really mean*. This finding was considered extremely important and it was also quite unexpected among the members of the group. According to the methodology, making progress in overcoming this obstacle will facilitate the resolution of the three factors that lie at the next layer up: Factor 14: Poor connection between statements of user needs and specific design requirements. Factor 60: The weakness of broad thinking from the disability lobbies. Factor 50: Lack of understanding of the marketing potential. In other words, when the 'handicap' community agrees on and defines what accessible products are, progress will be easier to achieve in the three following arenas:

[5] Cost Actions are networks of European scientists working on a specific subject. The European Community funds their coordinating actions and meetings.

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1. It will be possible to gain a better understanding of the relationships between user needs and specific design requirements
2. The disability lobbies will have achieved a broader thinking
3. The marketing potential of such technologies will be much better understood.

It was also interesting to analyze where factors, which were identified by the participants as being the most important, were located in the RCM. The instinctive expectation is often to think that they will be located at the foot of the tree. This was clearly not the case: of the five factors that received the most votes, one was in the top level, one was in the second level, two were in the fourth level and one was in the fifth level. This means that other issues, not perceived by the "collective wisdom" of the experts as the most important factors, have to be addressed first in order to resolve what are perceived as the most important issues. In sum, herein lies the strength and true value of this methodology. Despite the discounts given by adding a virtual asynchronous component, it still yielded an excellent structured road map, that none of the individual experts could have foreseen. The detailed results appeared as a book chapter (Laouris & Michaelides, 2007) published by the European Commission and serves the development of the 2007-2010 strategy of these scientists' network.

World history was made in a synchronous global interactive WebScope Dialogue facilitated by Aleco Christakis on the island of Crete on July 21, 2006 (http://sunsite.utk.edu/FINS/loversofdemocracy/Premiere_WebScope.htm). For the first time, the actual structuring phase of SDDP was implemented using virtual technologies with participants being geographically separated. A group of nine students of "Democracy and The Enlightenment" brought on from the Flinders International Asia Pacific Institute, in Adelaide, South Australia, with other members of the Knowledge Management Team (KMT) spread over various locations in the United States (Kenneth K. Bausch, an expert in systems sciences and Marie Kane, an expert in corporate marketing, located at Fayetteville, Georgia, Diane Conway, computer software and Internet conference system operator, located at Paoli, Pennsylvania, and Vigdor Schreibman, reporter/observer from FINS in Washington, DC). A Global Boundary-Spanning Dialogue, all together in the world of Cyberspace, at different local times and places. Distant participants were able to view the same screen of the Cogniscope as those present in the room using Claripoint, special software that allows broadcasting of a computer screen through the Internet. Their virtual presence in the room was made possible using traditional telephone conferencing.

During the week of WebScope/Email Dialogue, between July 14 and July 21 2006, the KMT guided the student participants in their asynchronous response to a triggering question: "*What factors will help significantly in rescuing the enlightenment from its failings?"* During the first six days, the students generated a set of 49 factors. They subsequently carefully clarified these factors, so that everyone had a good understanding of the meaning of each other's ideas, using only their email facilities. The set of factors were then classified into 9 clusters, and prioritized subjectively by relative importance. The KMT organized all the information efficiently and periodically returned pertinent KMT Reports (http://sunsite.utk.edu/FINS/loversofdemocracy/LoD_Dialogue-1/FinalReportonFactors071706.pdf) to the student-participants, who were the "content-experts" of the group dialogue, so that they could concentrate their attention on producing the content of the dialogue. Then, on the seventh day, the whole group engaged in a synchronous focused and open dialogue *via* the WebScope for approximately three hours. At this session the student group at Adelaide, South Australia guided by lead facilitator in Crete, with the *KMT* in Georgia, Pennsylvania, and Washington, DC produced a Root Cause Map, RCM, (http://sunsite.utk.edu/FINS/loversofdemocracy/LoD_Dialogue-1/RootCauseMap072106.ppt) disclosing the influence tree among factors of higher relevant importance. The production of the RCM enabled the group to discover the root causes of the failures of "Democracy and The Enlightenment," which could guide future collective collaborative action.

The RCM disclosed three factors that must be addressed before a recovery of "Democracy and The Enlightenment" could be realized. These are considered to be the true drivers in the very complex issues addressed by the group. The first of these root causes, pointed to the extremes of either optimism or pessimism that guides public administration and political economy. This, contrasts with research that shows the large benefits of policy guidance, not by experts, but by the ordinary people (see for example, Yankelovich and Harman, 1988). The second root cause disclosed the need for improving local governance by using local knowledge. And the third root cause disclosed the need to make room for the exercise of power by minorities. Overcoming these three root causes is the key to generating mutual respect and greater trust, which are essential elements of success of any community or society.

According to the final report, the global dialogue communications via telephone conferencing and Internet connectivity was subject to local weather disturbances and power outages. These interruptions will require careful monitoring in future applications of the Webscope model to assure best practices.

In sum, the virtual co-laboratory produced results that were considered by the experts to be of highest quality and comparable to those that would have been produced in the context of a longer session taking place in a face-to-face physical setting.

The third application of SDDP addressed the needs of another group of European scientists (Laouris, Michaelides and Sapio, 2007). The Cost298 network aims to facilitate empowerment and participation of all in the broadband information society. The triggering question was formulated to derive the obstacles (psychological, social and technical) that prevent the wide public from benefiting and participating in the broadband society. Similarly in the previous examples, the triggering question and preparatory remarks and explanations concerning the methodology were emailed to all participants before the physical meeting (Larnaca, Cyprus 28-30, September, 2006). The participants generated 82 factors. Similarly to the Cost219ter model, a group of knowledgeable experts clustered the factors into 11 categories. This time, greater effort was made to plan the process as strictly as possible so as to comply with the time limits given by the sponsors of the dialogue. Namely, it was agreed that the co-laboratory would be implemented in only 4 hours. Despite the rigorous preparations, again, it was impossible to complete the phase of creating the Root Cause Map within the given time limits. The co-laboratory was completed within two additional hours on the following day.

Interestingly, Factor 30: Inadequate promotion of it's (i.e., broad-band's) importance and Factor 49: Lack of User Friendliness emerged as the root drivers, although they only received 4 and 5 importance votes respectively (highest was 12 votes). On the contrary, Factor 4 (Low level of digital literacy), which with 12 votes was considered by the group as the most important factor, found itself at the top of the RCM! Similarly, Factor 7 (Absence of specific services oriented to users needs) and Factor 11 (High cost of service) with 8 and 6 votes respectively were again positioned at the very top of the tree. Experts in the Cost298 community felt that this finding was extremely important because it encourages them to re-focus their global efforts towards the right directions.

The final application of the revised model was tested within politically sensitive context, namely the effort of some peace pioneers in Cyprus to revive the peace process (Laouris et al., 2007). A number of requirements made the implementation of the model on this particular problem especially interesting:

1. Due to the negative outcome of the 2004 referendum to the UN peace plan, Cypriots are not only disappointed and reluctant to invest further time and hope in the peace process, but also partly scared to participate in peace revival co-laboratories, because certain political public debates accused peace pioneers for their initiatives (Droushiotis, 2005).
2. The potential participants are geographically separated. Greek Cypriots are spread all over the southern part of the island (some more than 100 Km away from the capital city) and Turkish Cypriots are located in the northern part. Furthermore, the sponsors wished to secure the participation of selected peace pioneers based in the US, UK and Brussels.
3. The anticipated stakeholder participants are practically experts with very rich knowledge and ability to evaluate and analyze the current situation.

The model incorporated extensive exploitation of information and communication technologies. The following modifications were tested:

1. The triggering question was formulated before the co-laboratory by a team of knowledgeable individuals (peace pioneers; the same who also envisioned the peace revival process) and was sent by email to all potential participants. The participants were not chosen before the co-laboratory as in classic co-laboratories. An invitation was sent to a larger list of over 60 individuals (8 October, 2006), known to be active peace builders in the past. At the end 25 decided to participate.
2. The process engaged people who reside in Cyprus (both sides of the Green Line), Cypriots who live abroad (mainly US, UK and Brussels), as well as international experts of SDDP.
3. The triggering question "*What factors contribute to the increasing gap between the two communities in Cyprus?*" was sent to all participants in October 2006. Two weeks were provided for email interactions and factor clarifications. The KMT sent the list of 107 factors produced and their clarifications to all participants.

4. A group of four experts met physically for 3 hours to cluster the factors. Twenty clusters were produced.

5. The first synchronous meeting took place about a week later. Four GCs and four TCs were physically present, three GCs and one TC were remotely connected using multiple communication technologies (see below). Five international members of the scientific crew tested all technologies. The discussion lead to the deletion (merging with others) of three factors and addition of some more. The total number of factors was increased to 114. Ten factors were moved to other categories. A decision was made to contact five participants not present and request clarifications and re-wording of their statements. This co-laboratory was supported by a rich repertoire of communication technologies described in detail in section 3.3.

6. The voting of factors considered by participants as the relatively more important was performed asynchronously through email. Participants were again allowed enough time to consider their best choices. The entering of their votes in the Cogniscope software was performed asynchronously, but in the context of a physical co-laboratory, by a small sub-team of the KMT.

7. The generation of the tree was performed during two synchronous co-laboratories, which took place on the 20th of October and 28th of December, 2006. The first co-laboratory was again supported by rich and diverse communication technologies, while the second and last part of the structuring process took place in a physical setting without options for international stakeholders to participate.

The lessons learned from the above co-laboratories were compiled to finalize the model described in this paper. The model of the synchronous interaction of the participants described here has been applied almost intact during the organization of the last of the co-laboratories described above. The limitations and shortcomings are considered in the concluding discussion.

In the following sections, details are given for aspects of the model, focusing primarily on the roles and the communication technologies of the synchronous interaction. More theoretical aspects of the "technology of democracy" model, including the asynchronous interaction, are described in another paper published in this issue of the Journal (Schreibman and Christakis, 2007).

3 Technology of Democracy Model re-defined for the broadband era

Fig. 1 summarizes the network and technologies available in our implementation of the virtual SDDP model.

3.1 General requirements of the set-up and the technology at the co-laboratory's site

According to Christakis and Bausch (2006), a well-designed and conducted SDDP face-to-face co-laboratory, which they call co-laboratory, is characterized by the following physical characteristics:

- Comfortable chairs
- Proper sitting arrangements
- Sufficient wall space to display the results of participant observations and decisions;
- A screen or wall on which developing information such as triggering questions, definitions, observations, influence patterns and option profiles can be projected
- Computers, projectors and printers

The proposed set up must fulfill in all respects the above requirements, except that it should include a number of additional communication technologies. The following technologies must be available at the co-laboratory's site in order to meet the additional requirements.

1. **Computer running Cogniscope**. As in a traditional co-laboratory, the screen of a computer running Cogniscope is projected on the wall using a beamer to serve all participants. In our virtual SDDP model, the same computer uses remote-screen software such as Claripoint to broadcast this same screen over the web to all those participating from remote locations.

2. **Telephone conferencing or video conferencing**. The remote participants must be able to listen to and participate in discussions taking place in the co-laboratory room. This is satisfied through the use of a traditional telephone conferencing service. If the budget allows, the telephone conferencing can be enhanced adding video conferencing.

3. **Computer running Skype and/or other instant communication tools**. In our tests we used Skype as the main communication tool to connect distant participants with one another and with an operator stationed at the co-laboratory's site.

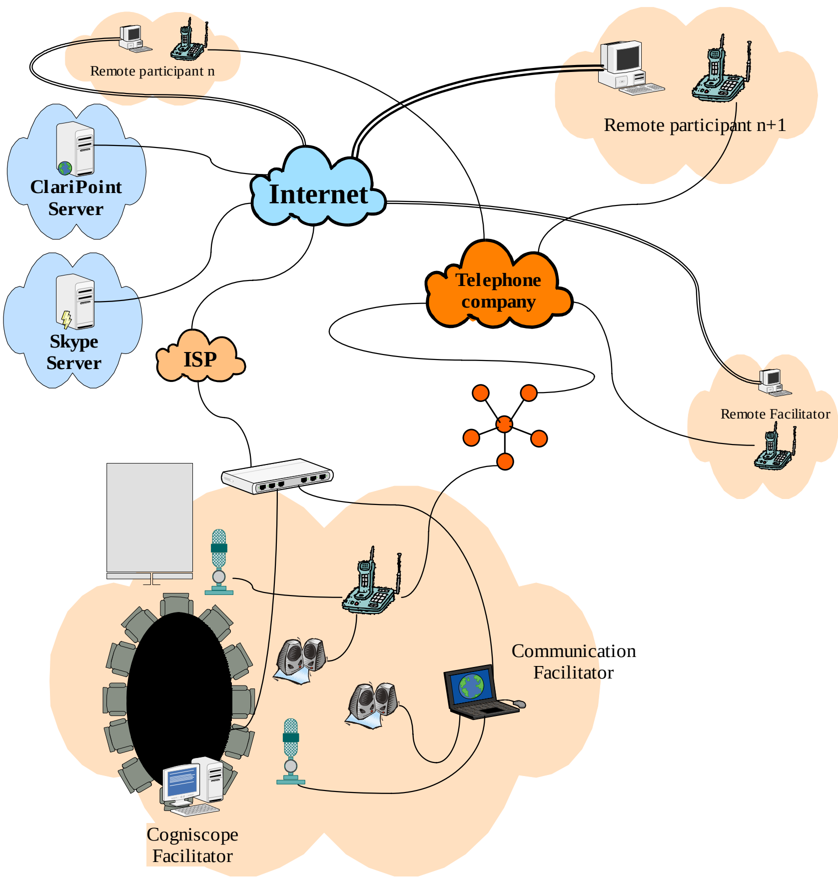

Fig. 1. Overview of network connectivity during the synchronous SDDP co-laboratory

3.2 Technology requirements from the point of view of the remote participant

In order to be able to participate effectively in the co-laboratory, a remote participant needs to be able to do the same things and enjoy the same facilities as those physically present. The following paragraphs explain these requirements and point to technology solutions available to the participant to satisfy these requirements.

1. **Listen and participate in on-going dialogue**. The remote participant must be able to listen to the disciplined dialogue, taking place in the co-laboratory room. S/he must also have the option to participate in the discussion, clarify his/her contributions when they are discussed, ask questions, etc.

2. **See what the other participants see**. The participants who are physically present see the projected screen of Cogniscope on the wall. Each relationship is explored and discussed while the two factors are projected in large fonts, easy to read, on the wall in front of them. In our implementations we offered remote participants the possibility to view exactly the same computer screen as those

present in the co-laboratory facility using the remote screen capability of the Claripoint software.

3. **See the other participants face-to-face.** Those present in the co-laboratory facility have the benefit of being able to see each other. Of course this feature is difficult to simulate without using expensive video conferencing equipment. However, we used the video feature of Skype to broadcast views of the physical setting to selected remote participants. When remote participants wanted to share their ideas "in person" we beamed their video streamed through Skype on the co-laboratory's screen.
4. **Vote**. The SDDP requires participants to continuously vote in the construction of the Root Cause Map. It is easy for the Co-laboratory Facilitator to simply ask participants to raise hands and count them if they are all physically present. In the case in which some participants are not physically present, their votes need to be collected via another channel and communicated to the person who will enter the voting results in the Cogniscope (we call this person, the Cogniscope Facilitator; see below).
5. **Get a hard copy of something or a renewed copy of a Cogniscope report**. In a physical setting, participants may receive ad hoc a copy of something that has not been sent to them previously, photocopy something they forgot to bring with them or receive a revised version of one of the Cogniscope reports as it evolves during the co-laboratory.

3.3 Multiple communication channels

The resulting model is characterized by: (a) multiple communication channels, which enable both physical and virtual participants to engage is smooth and efficient interactions, (b) a multitude of technologies available at the co-laboratory's site, and (c) specific hardware and software requirements at the virtual participant's site.

The following sections expand on these requirements and discuss the minimal configurations required for the implementation of successful virtual co-laboratories.

During the asynchronous phases, participants need only access to email. For the purpose of the synchronous co-laboratories, a number of different technologies were made available simultaneously. These included the following:

1. **Telephone conferencing**. A telephone conferencing facility was organized with a private telecommunications company (in the case of Cyprus, with Golden Telemedia who generously provided the facility for free of charge). The facility allowed for up to 20 participants to join simultaneously the telephone conferencing virtual room, by calling a regular number in Cyprus. Following a welcoming message ("Welcome to the first interactive management virtual conference -Harnessing the collective wisdom of peace pioneers"), the caller was asked to enter a password. The caller had the option to mute his/her device (pressing "0") and to re-activate (pressing "5") again if s/he needed to engage in other conversations or more than one participants were sharing the same

internet/telephone and wished to discuss something privately or without disturbing the other participants.

2. **Remote Screen software**. The Vista product of Claripoint (www.claripoint.com) was used in order to "broadcast" the Cogniscope screen to all remote participants. The account that belongs to the Institute of 21st Century Agoras was made available by Dr. Ken Baush, who is the Executive Director of the Institute (www.globalagoras.org). Remote participants were able to see exactly the same screen as the screen beamed using the projector for the participants who were physically present at the premises of the Future Worlds Center in Cyprus.

3. **Multi-Channel communication based on Internet**. We used Skype (www.skype.com) to enable participants engage in one-to-one and one-to-all chat communication, one-to-one and one-to-many telephone conferencing and Co-laboratory site-to-single participant video (i.e., we turned the camera manually towards participants present at the co-laboratory's site in order to enable distant participants share the excitement). In addition, Skype was used to send files to specific (or to all) remote participants on the fly as required or as requested during the co-laboratory. These multiple channel communication system provided solutions to many requirements at the same time.

3.4 Personnel and Roles

The personnel required to implement a hybrid co-laboratory using the model reported in this paper is significantly higher compared to that of a traditional same-place, same-time co-laboratory. The reason is because communication between those same-place participants physically present in the co-laboratory's facility and remote participants at different places must be kept ambient[6] and fluid at all times. Furthermore, technology must be ambient and add no extraneous cognitive load to the facilitation team. The following roles are essential for the members of the facilitation team:

1. **Co-laboratory Facilitator**. An experienced facilitator as described in (Christakis, 2006), not bounded to sit in front of any technology, focuses on conducting the dialogue of the co-laboratory. The only requirement that s/he must satisfy is to ensure that the various microphones remain in proximity to the person talking in order to enable remote participants to listen to both him/her and the other participants. Remote participants may receive voice signals from

[6] According to Wikipedia, the concept of **ambient intelligence** refers to a future scenario where humans are surrounded by computing and networking technologies, which are unobtrusively embedded in their surroundings. The concept was developed by the ISTAG advisory group to the European Commission's DG Information Society and the Media.) Briefly, systems and technologies need to be sensitive, responsive, interconnected, contextualised, transparent and intelligent.

different sources (i.e., Telephone, Skype), an issue that slightly complicates the dialogue process.

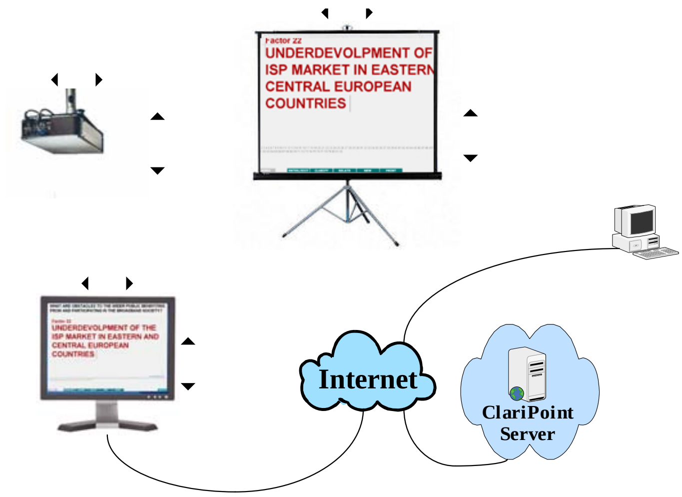

Fig. 2 Cogniscope screen. The output of the Cogniscope software is sent to a beamer, which projects it for the participants physically present. The same output is broadcasted to distant participants through the Internet using Claripoint software.

2. **Cogniscope Operator**. Another experienced member of the facilitation team administers the Cogniscope software. His/her computer is not only connected to a beamer, but also to the Internet (see Fig. 2). The beamer projection serves the needs of those present in the facility. Remote-screen software was used to broadcast the current screen of this computer to remote participants. We have tested and used Claripoint for this purpose, but one should remain open to new solutions that make it into the market every day. The Cogniscope Operator enters the system as “Presenter” and performs the same tasks and functions as in regular SDDP co-laboratories with the only additional load that s/he must ensure that remote participants remain connected to the virtual screen. This requirement imposes some extra load in that s/he must remain in continuous contact with the Communications Facilitator (described below), who would occasionally alert him/her that someone got disconnected, a new participant just entered the virtual conference, the system is down, etc. In such cases, the Cogniscope Operator needs to minimize the Cogniscope screen, check the status of participants in the Claripoint window, ensure that all remote participants are “accepted,” and connect to the remote screen. When these checks are done, the Cogniscope Operator must re-start the Claripoint web broadcasting and return to the Cogniscope screen.

3. **Communications Facilitator**. An additional experienced facilitator, preferably a person who is acquainted personally with the remote participants, serves as the link between them and those present in the co-laboratory facility. This person administers multiple and private channels of communication using Skype and/or equivalent technologies.

    - S/he serves as receiver of special requests by remote participants. For example, if a participant requires a copy of a table, the list of factors, the clarifications document etc, the Communications Facilitator sends the file through Skype without the others being distracted.
    - S/he can send private messages to remote participants. For example, s/he can alert a remote participant holding a microphone close to his/her keyboard and unintentionally contributing noise to the virtual telephone conferencing.
    - Occasionally, uses the video channel of Skype to send a live picture to one of the remote participants or members of the international KMT. This augments the experience of remote participants by simulating virtual presence thus enhancing enthusiasm and commitment.
    - Helps those who use Skype to call the regular virtual conference telephone number remain connected on a high quality and noise free channel. Skype offers the functionality to call regular numbers at minimal cost. However, the quality of this channel is usually not optimal. Remote participants occasionally need feedback to improve the quality of their connection. For example, they must ensure that they use a high-quality head-set with built-in microphone moving with their head (to minimize noise) and that their computer speaker is not feeding the voice signal back to their microphone, thus producing echo and oscillations.

4. **Logistics and Voting Assistant**. A student or a person who is under training to become an SDDP Facilitator optimally assumes this role. S/he is responsible to take notes of tasks that need to be taken care of later. Examples include, sending an email to an author of a factor requesting further clarification, considering at a later point the merging of two factors into one etc. Furthermore, this person counts the votes from participants and informs the Co-laboratory Facilitator of the outcome. In doing so, this person has to add together the votes from those physically present and from those participating virtually. S/he achieves the latter task by staying in continuous communication with the Communications Facilitator. It is advisable that these two persons sit next to each other and use no voice communication to avoid further increase of noise in the room.

In sum, a remote participant had a number of technologies available to him/her. Some of them were absolutely essential for his/her effective participation while others were optional and served to augment the experience. In some cases, remote participants had redundant technologies and multiple channels of communication available to them.

4 Discussion

The purpose of this project was to investigate the feasibility of reducing the cost and shortening the time required for an SDDP application, while securing the fidelity of the process and of the products. Different types of information and communication technologies were applied progressively in the series of the four co-laboratories. The final co-laboratory exploited fully a repertoire of widely available communications and served as the prototype to develop the virtual SDDP model described in this paper. The various theoretical and practical requirements and shortcomings of the model are discussed below.

4.1 Investment in time and personnel

Whereas typical SDDP co-laboratories can be planned and implemented by even a single Co-laboratory Facilitator with the support of a Cogniscope Operator, the model of the virtual SDDP process proposed here requires at least three members in the facilitation team. The Cogniscope Operator is loaded with additional responsibilities compared to the case of traditional co-laboratories. S/he must ensure that remote participants remain connected to Cogniscope’s remote virtual screen at all times. The Communications Facilitator must fulfill tasks that require fluency in the use of technology and acquaintance with the remote participants. This person must remain alert at all times, communicating on one hand with the remote participants and on the other with the Co-laboratory Facilitator and the Cogniscope Operator. The optional Logistics and Voting Assistant supports significantly the Communications Facilitator.

The time invested in synchronous sessions with all participants was significantly reduced using the virtual SDDP model. Table 1 summarizes the time invested in synchronous and asynchronous phases in the four co-laboratories.

Table 1 Comparison of time invested in synchronous and asynchronous phases

Co-laboratory Title	Time in synchronous sessions (min)	Time in asynchronous sessions (min)	Time spent by Facilitators off line (min)
Cost219ter	570	100	200
Crete	180	120	180
Cost298	420	80	190
Peace Revival	360	140	240

During its first application in Cyprus in 1994 (in a co-laboratory analogous to the “Peace revival” co-laboratory described here), the SDDP required over 6,000 minutes of stakeholders’ time to produce 72 factors. The four virtual co-laboratories described here reduced this time considerably. The fourth co-laboratory consumed only 360 minutes in synchronous co-laboratories while only 140 min were invested asynchronously. Of course, one should take into account that at least half of the participants of the fourth co-laboratory had considerable experience with the SDDP. It is therefore reasonable to assume that their prior experience might have contributed to the time reduction. Nevertheless, the 360 minutes of synchronous time in connection with the fact that some participants were able to participate from distant locations represent a significant improvement in efficiency and cost.

On the contrary, the time invested by the facilitators and by small teams of experts between the synchronous sessions was greater. Especially for the last co-laboratory, the facilitators devoted more than 4 hours. The extra effort of the facilitators during the fourth co-laboratory can partly be explained on the ground of two factors: (a) The new virtual SDDP model was experimental and loaded with diverse technical complications and (b) the co-laboratory was taking place in the context of a politically sensitive and partly tense climate (Laouris et al., 2007).

4.2 Requirements and shortcomings of technology

The technology required to implement the proposed virtual SDDP model is widely available and the cost of using it is minimal. However, at the same time we must alert that the application of technology was not always smooth and we periodically faced different types of problems. In fact, the last session of the fourth co-laboratory was implemented without the virtual technology in place, because the facilitators felt that the local participants needed an opportunity to focus without disruptions of any type in order to complete their task. There were two reasons for these disruptions. The first was due to the fact that the composition of the group differed from session to session. The second reason was related to problems of technology. The use of traditional telephone conferencing interfered with skype-based voice communication. When distant participants used skype to call the co-laboratory telephone conferencing number, their connection added significant noise to the whole system. This made it difficult for all those using the telephone conferencing facility to listen without additional effort to the on line dialogue. Thus, when the two communication systems are connected we suffer in sound quality. There are two solutions to this problem. The first invites facilitators to restrict communication to just one system. Alternatively, the two systems should be kept separate sacrificing in group dialogue and connectivity. The two channels can talk via the Communications Facilitators as described in section 3.4

Another problem was related to the fact that a different input device (microphone) was used for each communication channel (i.e., one for the telephone and one for the skype). It is important to ensure that physically present participants keep the microphones close to their mouth (but not in front of it) when they talk. They must also talk slowly to allow adequate data streaming when the Internet connection is of low-bandwidth. A useful advice is to bind the skype and the telephone microphones together.

In sum, the virtual, web-based communications tools improve significantly depending on the available bandwidth. Therefore, it is reasonable to assume that as bandwidth becomes more available, the application of the proposed model will become simpler.

4.3 Grounding the model on the relevant laws of cybernetics

The SDDP is grounded on six laws of cybernetics (see introduction). Of the six laws, Ashby's and Tsivacou's laws are impacted positively by employing the virtual model, while Boulding's and Dye's laws are affected negatively.

Ashby's law of Requisite Variety is usually violated when certain points of view or types of observers are excluded. The virtual set up enables people, who live at remote places to participate and contribute. In some particular situations, it might even encourage the participation of people who might feel threatened or relactant to physically join a workskshop. This can add to the depth and breadth and of ideas generated. Of course it imposes an additional requirement upon the organizers: to identify and invite such participants.

The virtual environment increases the psychological distance between participants. This flattens power ranking. Particularly when remote participants happen to be people of certain rank or people with power, the fact that they are not physically present makes it also easier for the others to express their own ideas and opinions freely. This secures and increases the autonomy of the observers in line with Tsivacou's law of Requisite Autonomy.

The communication problems reported in the previous section could become serious if their extent is such as to interfere with the cognitive limitations axiom. The SDDP has been designed to fully respect the relevant human cognitive limitations. The interfering noise due to multiple communication systems and the distractions related to the effort of the facilitators to keep everybody on board at all times, might not interfere with the short term memory constrains of the human brain; it might, however, contribute to attention and concentration disturbances, thus accelerating mental fatigue. The fact that the results of all four co-laboratories are fully in line with Dye's law of Requisite Evolution of Observations supports the argument that these communication problems did not deteriorate the outcome. In all cases reported in section 2, the results highlight the differences between factors considered as most important and factors which exert a greater influence in the RCM.

The virtual SDDP model complies with the complexity axiom, which states that observational variety, be respected in the dialogue process. In the examples reported in this paper, we did not have the opportunity to invite stakeholders with completely opposite points of view. Being able to do so, SDDP organizers could increase comprehensiveness, in line with Churchman's assertion that the systems approach requires one to see the world through the eyes of another (1979). Especially in the case of Cyprus's political context, it would be extremely appealing to investigate how stakeholders with opposite perceptions of the current political status quo construct their obstacles-, vision- and options root cause maps. Specifically, Cypriot peace builders are faced with at least two challenges: (a) to construct and compare RCMs created separately by GC and TC stakeholders and (b) to invite those with a completely opposite political perspective (i.e., those who oppose the UN peace plan) construct their own RCMs and compare them with those constructed by peace builders.

Boulding's law of Requisite Saliency might have suffered slightly by the use of the virtual SDDP model. According to Christakis and Bausch (2006), the SDDP meets the requirements of this law in various ways including (a) having each observer clarify the meaning of his or her observation and (b) having participants consensually create clusters of similar observations. The application of the virtual model deprives participants the option to listen directly to the author clarifying his/her idea. Instead, they read the clarifications asynchronously and cannot listen to questions posed by other participants, or requests for further clarifications. They also miss the opportunity to engage in live interactions. At the same time, one could argue that they may spend more time, at their own convenience, to concentrate and study more carefully the precise written clarifications provided by respective authors.

The group does not do the process of clustering. Instead, a smaller group of knowledgeable individuals assumes that tasks[7]. Of course, this reduces the synchronous time required by the whole group. At the same time, participants do not “consensually” create clusters of similar observations, as required by the original SDDP application model, thus missing an opportunity for deepening understanding and learning from each other. In sum, the virtual SDDP is a compromise between our efforts to reduce the time required for co-laboratories vs. weakening compliance with the law of Requisite Saliency.

4.4 Virtual technologies in the service of combating group thinking

The term *mind coupling* or *groupthink* is used to describe situations, in which members of a group go along with what they believe to be the general consensus. Because of fear of upsetting the group’s balance, individual doubts or disagreements are set aside. Groupthink may thus cause groups to take hasty and irrational decisions. This situation has been observed in the case of Cyprus, where one particular political agenda managed to dominate over others, especially during the period of the political referenda, thus polarizing stakeholders to such as extend as to discourage them from considering other options. Such situations make SDDP particularly attractive, because of its inherent capability to combat groupthink. The term *Mindthink* was originally coined in 1952 by William H. Whyte in an article published in Fortune: "Groupthink is not about mere instinctive conformity —What we are talking about is a rationalized conformity — an open, articulate philosophy which holds that group values are not only expedient but right and good as well." Irving Janis expanded this definition "A mode of thinking that people engage in when they are deeply involved in a cohesive in-group, when the members' strivings for unanimity override their motivation to realistically appraise alternative courses of action."

The SDDP methodology invites participants to express themselves freely and encourages them to respect and understand each other. It enables stakeholders to avoid the erroneous priorities effect (e.g., like in the example of Cyprus; see also Schreibman & Christakis, 2006, 2007) in which people jump to action on the basis of what they agree are the *most important* issues, before they discover what the *most influential* issues are (Dye & Conaway, 1999). For this particular aspect of SDDP to become effective, it is crucial that participants represent diverse points of view, competing interests and different backgrounds. Indeed, based on empirical observations of centuries, the authors claim that without the active participation and engagement of the community of stakeholders, any action plan will fail. The virtual SDDP model enables the participation of remote stakeholders. It also makes an international KMT accessible. This significantly expands the spectrum and depth of ideas and options that can be generated. Therefore, the proposed virtual communication model enhances the capability of SDDP to combat groupthink.

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[7] The last of the four co-laboratories presented here was an exception, in which the clustering was done synchronously enabling all participants to contribute.

5 Summary and Conclusions

The model presented here reduces the time required in synchronous co-laboratories to a fraction of that required in traditional applications. At least three facilitators are required to implement the model. Communication with remote participants is simulated using mainly low-cost, web-based solutions. The primary requirement is software to enable the Cogniscope screen to be broadcasted to the participant's site. The model improves compliance of the SDDP with Ashby's and Tsivacou laws and improves our possibilities to counteract groupthink. Boulding's law of Requisite Saliency might suffer slightly by the design, while there are threats for violating the cognitive limitations axiom if technology becomes dysfunctional.

The potential of the technology-assisted model of the structured dialogue process presented in this paper is incredibly exciting. Using widely available, low-cost, web-based tools, plain email and simple telephone conferencing systems, people from all corners of the globe now have access to a feasible methodology to discover, analyze and prioritize the true drivers of their most complex problems. Using Cogniscope over the Internet, they can create consensus action scenarios focused where they will have the most impact, while simultaneously educating one another about possible alternatives and options (Schreibman and Christakis 2006, 2007). Making feasible the participation of remote stakeholders, who are out-of-the-physical context, as well as taking advantage of the wisdom and experience of an international KMT, contributes towards deepening the dialogue, producing higher quality products and making action plans more feasible.

Future applications of the method and exploitation of more virtual technologies will lead to further development. Furthermore, a distance-learning program planned by LOVERS OF DEMOCRACY will enable a wider public to have an affordable way to learn how to lead group dialogue.

In conclusion, the four experimental applications of the new model left little doubt about the potential benefits that will likely result from the marriage of the Structured Design Process and virtual communication technologies.

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