

Lost in Translation: A Critical Analysis of Actors, Artifacts, Agendas, and Arenas in Participatory Design

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ABSTRACT

As computer technologies start to permeate the everyday activities of a continuously growing population, social and technical as well as political and legal issues will surface. Participatory design is asked to take a more critical view of participation, design, technology, and the arenas in which the network of actors and artifacts dialectically construct the social orders. This paper has a much more modest aim of that to contribute the discussion of participation and design in part by a more in-depth understanding of the translation problem among different actors who directly participate in participatory design activities. This problem takes place when different actors come to participate in the design activities and when they are to decide whether to adopt and use a designed artifact. By analyzing a multi-year-long effort to understand and provide social and technical means for the use of educational computer technologies in special education, this paper aims to shed new light on the understanding of this problem. The *arenas of participation* framework is employed to frame the different social orders in which actors act, carry out their work practices, participate in design processes, and ultimately make use of this artifact. While fundamental to the democratization of the design of sociotechnical solutions, participatory design may not be sufficient to reveal all sociopolitical issues of work practices that surface in its adoption and use. It is necessary to take into account the different arenas in which their design and use are carried out.

Categories and Subject Descriptors

K.4 [Computers and Society]: Public Policy Issues – *Privacy and Regulation*; Organizational Impacts – *Computer-supported collaborative work*; Social Issues – *Handicapped persons/special needs*;

General Terms

Design, Security, Human Factors, Legal Aspects.

Keywords

Participatory design, actor-network theory, arenas for participation, translations, Web2gether, special education, social networks,

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adoption, privacy, collaboration.

1. INTRODUCTION

Participatory Design (PD) has evolved to become a mature research area and design practice among computer professionals. The Scandinavian versions of PD, which were concerned primarily with the politics of design—namely workplace democracy and political conditions for user participation in the design and introduction of the computer [14]—have evolved toward an in-depth understanding of the nature of participation, and the development of methods and techniques for favoring user participation at early stages of design, namely co-design and co-evolution of computer artifacts. Computer technologies and the social contexts of use have also changed since the initial work on PD. At workplaces, for example, many of the initial claims and arguments put forth by the PD community have become intrinsic to work practices and norms.

As computer technologies start to permeate the everyday activities of a continuously growing population, social and technical as well as political and legal issues will surface. Indeed, experience with participation is much broader, as Gärtner and Wagner have argued [10]. In particular, in reaching out beyond the traditional office work environments, PD is asked to take a more critical view of participation, design, technology, and the arenas in which the network of actors and artifacts dialectically construct the social orders. This paper has a much more modest aim, however. It aims to contribute the discussion of participation and design in part by a more in-depth understanding of the translation problem among different actors who directly participate in PD activities. Understanding translation is key to a more effective, valuable, and direct partnership between designers and users.

PD can bring together field-study methods and participative design activities to facilitate the creation of a common language between designers and users. The goal is to integrate “systemic analysis, appreciative intervention, and practitioner participation” [13] to create social-technical-political conditions that reduce the gap between design practices and users’ work practices. Whereas in-depth fieldwork, such as videotaped participant observations and in-depth interviews, helps designers understand the nuances of users’ everyday practices, participative design activities, comprising tools and techniques such as future workshops, case-base prototyping, and cooperative prototyping [19] were developed to provide users a means to take an active part in technical design.

PD is instrumental in creating a common language, and thereby a stronger relationship between designers and users [13].

These methods, tools, and techniques are not without limitations, particularly when it comes to *translating* different actors' needs, goals, motivations, and values. For example, in conducting a series of site visits and workshops, researchers are able to collect much information on users' work practices, environments, and technologies, as well as preferences, values, and norms. A superficial analysis of these data, however, based on a literal translation (or interpretation) of users' accounts, can yield only a partial account of the work practices and needs in question. Additionally, by effecting and shaping the design decisions mainly in the design arena [9], PD is likely to overlook the influence on actors' decisions and choices as well as their perceptions and understandings (situated model) when networks and agendas (hidden or otherwise) are activated when new technology reaches the institutional (or industrial) arenas. This paper thus argues that for PD researchers to have a deeper understanding of the translation problems, they ought to reach out beyond the arena of design.

By analyzing our three-year-long effort to understand and provide social and technical means for the use of educational computer technologies in special education, this paper aims to shed new light on understanding the *translation* problem. Specifically, PD was employed to facilitate the design of a collaborative peer-to-peer technology, Web2gether, to help special education professionals find educational resources as well as receive professional and social support. The challenges of promoting the widespread adoption and use of Web2gether have motivated a more in-depth analysis of the networks of actors and artifacts (or intermediaries) that were activated as we moved the design of the system through different sociopolitical arenas. To this end, this paper employs Gärtner and Wagner's [9] *arenas of participation* framework to frame the different social orders in which actors act, carry out their work practices, participate in design processes, and ultimately make use of technology. This framework is also inspired by the actor-network theory to analyze the sociopolitical issues that have impacted the use and adoption of the system.

2. ARENAS FOR PARTICIPATION AND NETWORKS OF ACTORS

This work builds on and integrates Gärtner and Wagner's arenas of participations [9] and actor-network theory [3]. It extends the existing literature by adopting a relational (network) perspective on the study of (participatory) design and adoption of collaborative technologies. A relational approach looks at the actors who participate throughout the design and use of a technology and the set of types of relationships that link each other. The patterns that emerge from these relationships come then to create social structures and norms of the design and use context. In this respect, this approach does not take the arenas as given—"places" in which actors interact and act—but as socially constructed by the interactions that take place among the actors, mediated or not by external artifacts or intermediaries. This separates the relational approach hereinafter described from the traditional structural analysis that departs from already established structured settings, or arenas, at the outset.

Despite its unquestionable relevance to design, development, and deployment of new technologies in workplaces, the quest for

unmediated relations and close partnerships between designers and users is not sufficient, according to Gärtner and Wagner [9]. These authors also argue for a more in-depth understanding of agenda settings, the "political and social forces that shape the practice of design and participation" [10, p.37]. Thus, they distinguish three major arenas of participation:

Arena A – *Designing Work and Systems*: The individual project arena where specific systems are designed and new organizational forms are created. In this arena, we find the most direct and unmediated partnership between designers and users.

Arena B – *Designing Organizational Framework for Action*: The institutional area where "breakdowns" or violations of agreements are diagnosed and stable patterns of organizational functioning are questioned and redesigned.

Arena C – *Designing the Industrial Relations Context*: The national arena where the general legal and political framework, which defines the relations between the various industrial partners and sets of norms for a whole range of work-related issues, is negotiated.

Such social arenas provide a grounded mapping of system design (as well as development, deployment, and use) in space and time [9]. They can be seen as different "*social spheres*" of participation and interactions in which different sets of actors and artifacts come together to discuss common projects, ideas, and concerns. They are, in part, *places* in which PD activities and the use of the technology are realized. They are not necessarily constrained by organizational boundaries, and the debates that are held in such places reflect the networks, values, belief systems, and social worlds each participant (collectively or not) brings to bear in the arena. In this respect, participation is what defines the boundaries and, more important, the legitimate agendas for the debates.

At its early stage, PD attempted to link these three arenas by exploring local conditions that influence policies at the national level (Arena C) [14]. The recent focus on partnerships between designers and users emphasizes work centered on Arena A at the cost of fewer PD projects being engaged at the organizational level (Arena B), and has lost sight of the importance of participating at the national level (Arena C) [12].

This paper offers a more in-depth analysis of the consequences of overlooking the influences of the organizational and national levels at the deployment phase of a technology that was initially designed in partnership with users at the individual project level (Arena A). In particular, it argues that such influences could only be felt when the networks of actors and artifacts at Arenas B and C were mobilized. Each arena "hosts its own political framework which in turn shape what its inhabitants hold as a legitimate standard, value, interest, or procedure [9, p.193]. PD activities should not be limited to the participatory activities or partnerships created at Arena A, but should also involve the new networks that were formed during the deployment phase of the project.

In Gärtner and Wagner's work [9, 10], Arena A encloses two sociopolitical processes through which systems are designed and new organizational forms are created. These are necessary and mutually constituted processes whereby (re)designing work shapes technical systems, and vice-versa, and together they create

meanings of the work practices and legitimize new local agendas for learning, interactions, cooperation, and conflict resolution. In Arena A, sociotechnical conditions for work and technology use are constructed, but not without sanctions from the other two arenas. This tightly coupled interplay between system design and organizational change is more often the case in projects in which development is pushed by users and/or managers (often in in-house projects). In essence, such a tightly coupling requires participants' power to make the necessary (political and otherwise) changes in work practices, as well as in the technology to better accommodate the new design requirements as they emerge from PD activities or, more important, from the actual use of the new technologies.

Although highly desirable and necessary in our research project, we found a mismatch between the goals and needs defined in design arena and the ones in organizational and national arenas. Commonly in highly institutionalized organizations, organizational views and actions are defined by strict norms designed in Arena B and regulations established in Arena C. Thus, technologies and their use are often defined at the organizational arena when not determined by regulatory policies at the district, state, or national levels. When the introduction of new technologies is required by law to be participative, participation often takes place through (elected or otherwise) representatives (e.g., unions or local committees), who mediate the design activities with designers' as well as managers' representatives.

In attempting to promote a more democratic or bottom-up approach for the design and introduction of technology at schools, we found that little could be done in terms of shaping organization norms. A great deal of effort thus had to be put on shaping the design of the technology to better fit existing work environments, practices, and norms. In a network of actors and artifacts, there was clearly a gap as well as an asymmetry between design systems and design organization. In part, this asymmetry alienated certain organizational (Arena A) as well as institutional (Arena B) and regulatory (Arena C) issues from the debates during the PD activities in our research project. That is, certain parts of special education actor networks were never mobilized at design time. Hence, translations were dominated by issues concerning the use of our particular technology, not necessarily the overall social-technical-political conditions of the use of the technology in the special education environment. The conflicts and contradictions among these arenas ultimately impacted the adoption and use of our technology in the schools. We further divide our analyses of Arena A into a design arena and a work arena to draw a clear picture of the issues that were observed in the fieldwork and those realized in the PD activities.

Social arenas are heterogeneous spaces that legitimize different agendas, actions, and interpretations. In each arena, interconnected (heterogeneous) actors participate collectively in the construction of norms and technologies, namely intermediaries (texts, technical artifacts, and incentive structures), which in turn mediate their actions and interactions in networks, or more specifically techno-economic networks [3]. Networks can be stable or under constant transformation and are recursively formed by the aggregation of actor-networks, in which intermediaries circulate and link all actors and networks.

In these dynamic networks, artifacts are "continually being reinserted into various socio-economic contexts, which constitute

different possible configurations" [3, p.77]. In this respect, the possible meanings of these artifacts are continuously being created and interpreted in different contexts dictated by the different network configurations. This can be also observed in the design or redesign of artifacts that carry a different stream of discourses and display "the scars" of various contexts that accompanied these (re)design processes [ibid.]. Actors thus inscribe their aims, problem definitions, design ideas, and agendas in the artifacts, which in turn reshape the social relations within the networks [9]. In so doing, actors are *translating* the meanings of the network within which they act in the design of the artifact. "Translation [thus] place[s] the inter-definition of the actors and its inscription in intermediaries at the heart of the analysis" [3, p.82].

3. DESIGN AS TRANSLATION

We defined design as a translation, or interpretative, process. Knowledge and understanding is not to be discovered, but to be created [1]. The essence of translating sociopolitical conditions of user contexts hinges on developing a "knowing how" of their practices, that is, integrating the knowledge of different arenas of participation that can be only constructed by those directly acting in the context of human activities, either purposefully or unconsciously [8], which are situated in social, historical, economic, and political settings. Essentially, they are "socially constructed" entities released from the traditional rational and objective view of human activities. In this context, different interpretations of complex settings are most likely to coexist.

This notion of an *interpretive flexibility* is very important as it demystifies the idea of an objective and universal interpretive viewpoint, and helps us understand that different groups regard problems and potential solutions often associated with a technology in different ways [22]. The power relations among groups of people also help us understand that the analyses as to why and how some technological interventions succeeded or failed are open to more than one interpretation, thereby inviting us to consider why, in a particular circumstance, one interpretation is more prominent [ibid.]. Moreover, this understanding can be completely achieved only through the analysis of the processes that created such circumstances, rather than just an emphasis on their outcomes. Only by studying people's actions will researchers be able to construct the meanings of what these people actually do.

Although studying people's actions can be regarded as the most direct or unmediated forms of eliciting a deeper understanding of how they construct their social order [20], these actions are not isolated from the different sociopolitical arenas in which people enact their practices. In this respect, PD is an attempt to create sociotechnical (as well as sociopolitical) conditions for unmediated participation of users in design. However, users' participation also mirrors (or translates) the various networks to which they are related [3]. Each network mobilized by an actor in a particular situation legitimates different standards, values, interests, and/or procedures. At the same time, actors' behaviors change according to the dynamics of the mobilized network [ibid.]. Thus, the translation is contingent on the place from which actors participate and the internal dynamics of the networks.

In participating, actors translate with several others with whom they maintain certain relationships. What actors do and propose is thus the consequence of a series of intertwining translation operations in mobilized networks. As PD activities take place in differ-

ent social arenas, the translations that are inscribed in design solutions thus result from the networks that are mobilized in different situations. The design becomes the materialization of the interactions among actors and their networks. Actors not only scribe their translations in the design, they also put forth their interpretations of the benefits, qualities, and expectations regarding the technology in design, as well as their interpretation of the technology itself, and perceived motivations (and perceived costs) to its use. At this points, the design and its meaning achieve its closure.

Translation theory [4] has been employed to analyze the adoption of a novel IT Management approach [5], and a structured method as a company's system development methodology [16]. This paper focuses on a critical analysis of the discrepancies in users' concerns, aims, expectations, and motivations when participating in the PD activities and when attempting to use the technology in their day-to-day activities. The network users mobilized while participating in the PD activities were different than those mobilized trying to use/integrate the system in their daily practices—*different networks are mobilized at different times*. We also observed the different networks or interpretations brought to bear by actors playing in different arenas—*different actors mobilize different networks*. Hence, the different arenas of participation as well as the different networks that were mobilized at various times and spaces directly affect the interpretations and understandings of the design as well as problem spaces in the PD processes.

4. DESIGNING A COLLABORATIVE TECHNOLOGY FOR SPECIAL EDUCATION

This section presents our effort to understand and provide the social and technical means for the use of assistive, instructional, and normal computer technologies in special education. Early in our investigation, we found that one of the major barriers for the adequate use of educational technologies in this environment was the lack of professional as well as social support to special education teachers, related service providers, and paraprofessionals. This shifted our original approach from simply offering a technical solution to facilitating access to these educational resources toward a socio-technical approach to offer means for participants to reach each other and thereby create and develop social networks through the use of peer-to-peer collaborative technology.

In the work and design arena (Arena A), we saw a series of conflicts and contradictions that emerged from the interaction between different elements that constitute the special education practices. In attempting to introduce a peer-to-peer support system in the schools as a means to overcome some of these limitations, we faced new challenges related to the impact of decisions and regulations from the institutional and national arenas (Arenas B and C), which created several barriers to the integration of the technology into special education work practices (the work arena).

4.1 Research Setting and Methods

The study took place at various schools in the Douglas School District (DSD; not the actual name). DSD offers special education support to more than 3400 students, ranging from students with mild learning or emotional disabilities to students with severe multiple disabilities. There are more than 165 special education

teachers (hereinafter referred to as “teachers”), and about 350 related service providers (more than 300 teacher aides, 15 occupational and physical therapists, and 30 speech language pathologists) in the district. The participants in the study worked in schools with intensive programs as well as neighborhood schools.

Data were collected through participant observation, semi-structured interviews, and informal open-ended discussions. We made site visits to different schools in the DSD to observe and follow the work of special education professionals. We also carried out semi-structured and informal interviews with teachers and related service providers to understand the issues pertaining to the use of technologies in the support of their students. At our PD workshops at the DSD IT facility and in our research lab, we first gave teachers an introduction of the goals of the research and the system, later encouraged them to try out the prototype of the system themselves, and finally invited an open-ended discussion concerning their experience and issues they might find relevant (or not) to their work practices and needs. We initially presented issues that were raised in the field-visits and previous workshops to foster discussion among the participants concerning issues specific to their practices and the technology under development. On average, the PD workshops counted on the participation of five practitioners, the subject-matter expert working on the project, and the researcher (fieldwork observer and major design architect of Web2gether). Most of these participants eventually participated in subsequent workshops (in the schools and IT department), training, usability studies, and participant observations. They were organized in a summer vacation after six months of fieldwork and design and implementation of the initial web-based prototype.

4.2 Arenas of Participations – Challenges and Opportunities

The design activities of Web2gether took place mostly in the design and work arenas (Arena A), which were instrumental in revealing the necessary information concerning the socio-technical conditions for the use of Web2gether. These conditions, although invaluable to the design of a usable and useful technology, were not sufficient to address or unpack the sociopolitical issues of the use of the system when we moved from this arena to the institutional and national arenas at the deployment of Web2gether.

We plan, in the next session, to further describe the participatory activities, present their outcomes to the design of Web2gether, and provide a more in-depth description of the work practices. Such a description was invaluable for understanding the current socio-technical conditions of the special education environments and facilitating the design of Web2gether. It nevertheless represents only a partial account of the whole picture because only part of the special education actor-networks was mobilized in the participatory activities and fieldwork. In fact, Web2gether itself became an instrument (or probe [12]) to further understand new issues by activating new parts of the actor-network when we attempted to introduce it in schools and foster its use. This unpacked a more in-depth understanding of the sociopolitical conditions of the work practices that had a direct impact in adoption and long-term use of Web2gether. The findings from this intervention will be further elaborated in the description of the issues that came out as we struggled to have the system used in schools.

4.2.1 Designing in the Design Arena

We implemented this first design iteration of Web2gether as a peer-to-peer-based *recommender system* [21]. It attempted to help caregivers not only find educational technologies, but also share lesson plans and other educational resources, such as educational websites, as well as their experiences. Our major aim was to allow users to help each other by creating socio-technical conditions for an open debate concerning the use of educational technologies in special education, through the creation and development of social networks. At the same time that Web2gether attempted to facilitate the formation and development of socio networks by bringing the contributors of resources and people in general to the fore of the interface, it also made use of the social networks people develop to make more accurate recommendations as well as to situate any information in the context of one's personal network. This emphasis on social networks and people came from our analyses of special education work practices and environments, which unveiled the extent to which teachers are isolated from each other within and across school boundaries.

The design of Web2gether involved a series of PD workshops in schools and in our research lab, site-visits, and training sessions at DSD IT department and in schools. PD Workshops and design activities followed an approach similar to Karasti's [13], which integrated participatory design activities with the analyses of prior ethnographic studies in classrooms to create a more complete picture of work-practices and the possible impact of technology in such practices. The main goal of our workshops was to foster informed and active participation of some members of the special education community in the design of Web2gether in light of issues that unfolded during the ethnographic studies, the implementation of the initial prototype, and the initial attempts to have members of the community use this prototype. In so doing, we aimed to raise some collaborative discussions concerning relevant and/or contradicting issues during the site-visits. Such issues are often invisible to practitioners in their day-to-day activities, and we wanted to test some of our assumptions and speculations that had direct impact in the design of Web2gether. We also wanted to contextualize the discussion on our experience designing the prototype to inform the redesign of the Web2gether system. The workshops resulted in a few recommendations for the redesign of the prototype, but, more important, they offered an important opportunity to create trust and build relationships for future collaborations.

These activities were followed by a new round of site visits, training sessions in schools, participant observations, and design and implementation of the new Web2gether. A more focused ethnographic study was made possible by these initial PD workshops. A more detailed account of the special education work practices and conditions is presented next. These accounts were critical to our in-depth understanding of the socio-technical conditions pertaining to the use of Web2gether in the classrooms, which highly informed its redesign.

4.2.2 Understanding the Work Arena

Special education is a complex social, technical, and political environment that involves not only relationships between teachers and students with disabilities, but also among parents, paraprofessionals, assistive technology specialists, related service providers, regular education teachers, social workers, school staff, and some-

times lawyers, each of which brings to bear individual agendas, motivations, goals, experiences, expectations, and needs regarding the education of these students.

“Low-Density” Problem and “Universe-of-One” Challenges.

Because the space of possible solutions to help students with disabilities forms a “universe of one,” the special education community suffers from a “low-density” problem in that there is often no one in the school or even the district with whom special education professionals can interact and ask questions regarding their particular problems. Whereas general education teachers can usually find opportunities for sharing their ideas for lesson plans, new materials, and support with their peers in informal encounters across the hall, there is little or no opportunity for special education teachers to share their experiences, new ideas, and technical solutions in accommodating students' special needs. These teachers rarely have time to participate in extra-class activities, which are often the only opportunity for this type of face-to-face encounter. “I see the other [special education] teachers as a distant family, but I have no chance to meet with them,” explained one teacher.

Isolation. Special education teachers are also likely to be physically and professionally isolated within the school. Teachers in the field-study pointed out the difficulties in building relationships with regular education teachers, which is nevertheless instrumental to guarantee a smooth transition between general and special education activities and inclusion. They asserted that they tend to be “out-of-the-loop,” and have difficulties in coordinating and communicating with the regular education teachers in their schools regarding classroom and outside activities.

Educators as Managers. The education of students with disabilities is a much more complex endeavor than simply adapting the regular curriculum to meet the special needs of the students, which, while important, is only one among many challenges to providing the most adequate support for the education and development of these students. The challenges faced by special educators, particularly in multi-intense classrooms, are not different from those commonly found in traditional office environments, with a tension between interruptions and need for information and the constant time pressures [2]. Hence, the work of special education teachers can be better characterized as the *management of each particular student's case* (or *case-managers*) rather than just teachers—focused on the support of each individual student and his or her *unique* needs. As a manager, most of the teacher's time is spent doing paperwork, communicating with other professionals who interact with the students, constantly dealing with emerging issues and making sure that every single student has all the support she or he needs to carry out assigned activities. In addition, the teacher needs to know the whereabouts of each student throughout the day. This notion of teachers as case-managers is a fundamental shift from the traditional view of classroom activities toward a more dynamic and complex one in which problems are constantly addressed by dedicated individuals as they emerge.

4.2.3 Institutional Arena in the Adoption of Web2gether

Despite the extremely rich picture of the work arena we drew from our collaborative design activities and fieldwork—an in-depth understanding of the socio-technical conditions to the use of the technology—we were unable to foresee the sociopolitical

issues on the use of the technology in teachers' work practices, which were revealed in the deployment of Web2gether in schools. In addition, we dealt with the sociopolitical implications of trying to bring parents and teachers together in the same collaborative online environment.

The analyses of the institutional arena drew on a series of site visits, semi-structured interviews, and training sessions when we introduced and deployed the technology in the schools, and eventually opened it up to a larger audience to include parents. The issues that follow came from several discussions with teachers, related service providers, managers, and parent representatives about the design and use of Web2gether.

How Much Discretionary? The introduction of Web2gether in the classroom took a bottom-up approach, relying on users' own discretion to actively participate and use the system. Despite the strong ongoing support at the management level, in particular the special education director and staff, Web2gether was introduced at schools as a third party supporting system rather than an "official" system from the district. As such, Web2gether was never meant to replace and/or augment any existing system or official practices, but to be added to the pool of support systems made available to teachers at their own discretion. While a bottom-up approach to the introduction of technologies in workplaces is often regarded as positive, not to say desirable, when such a process takes place in very institutionalized work environments such as special education, challenges emerge.

A number of meetings were carried out with the director of special education in the district to report the state of the affair and to receive advice on how to proceed with our interactions with the teachers and staff. These meetings were instrumental to a deeper understanding of the sociopolitical issues regarding the use of technologies in special education from the institutional as well as national arenas (Arenas B and C). We observed that Web2gether was mostly regarded by the management level as repository of education resources as opposed to a collaborative knowledge and social-network building system. This duality in the perceived role (and thereby benefits) of the system directly impacted the type of "official" support given by the district, such as the focus on creating a critical mass of resources available to the teachers. This in part contradicted the design principle of a peer-to-peer system in which the community builds such a critical mass, instead of a centralized publishing enterprise.

In focusing on educational resources, managers took a pragmatic stake and acknowledged the difficulties of having teachers collaborating with one another without a major structural change. In part, this acknowledged that teachers would need first to clearly see the benefits of using the system and then to start using it for building networks and collaborating. A major departure from existing socio-cultural practices requires a major effort to provide users enough benefits that can exceed existing (real and perceived) costs and adoption barriers. Such benefits might come from the design arena itself such as lowering the costs of the technology in its design (i.e., to improve usability) and offering resources of high value for its users (i.e., to improve usefulness), or from the institutional arena, such as changing the incentive structure of the work practices.

How Much Mandated? Bottom-up approaches are often associated with the democratization of the use of technologies and di-

rect involvement with the design by those who own the problem. Discretionary adoption is the major determinant in the adoption of single-user and groupware applications [18]. Recently, *bottom-up processes* have become more accessible with the use of collaborative systems, which potentially enable more equalitarian participation by all. These new systems allow users not only to collaboratively access information and construct knowledge, but also to be involved in collaborative decision processes that affect their lives [2]. Despite the benefits of such a process, particularly in offering users ownership and control over it, we faced daunting challenges in attempting to introduce this collaborative technology in a highly institutionalized work environment. This required not only some learning effort, but also a major structural change in the work practices and incentive structures to enable the benefits in using Web2gether to come about. The benefits of collaborative technologies are not direct; they hinge on the need for achieving a critical mass. The benefits come from active participation and peer-to-peer support. Paradoxically, given the limitations and challenges, these professionals are usually unable to perceive the benefits of a change, especially when the benefits are solely realized from the change.

A top-down approach involves risks, which can stem from the technology itself, from its lack of robustness and stability that can get in the way of existing work processes, to the danger of overlooking existing (hidden) norms and processes that can in turn hamper the adoption of the technology or hinder these processes. For example, the failure of upper management to realize the contradiction created by a mandated attempt to deploy a collaborative technology in a highly competitive work environment [17] as well as the imbalance between "who does the work and who benefits" [11] have hindered the adoption of other groupware technologies. We attempted to increase the benefits of using Web2gether by tightly integrating it with the actual communication practices in the districts. To this end, we offered the system to be "officially" used in the district for communication between managers (in the district, coordinators) and special education professionals. We, however, faced various resistances from managers that can be related to the technology itself and its current levels of acceptance and diffusion in schools, as well as the perceived risks involved with the use of such technology and control over it.

In the course of this research, the cost of discretionary participation was offset by local political issues that took place in the national arena (Arena C). Negotiations between the teachers' union and school board went awry. Despite the salary raise voted for all teachers (regular and special education), a new salary structure was introduced by the school board that canceled the net gain. This mobilized the union to encourage teachers not to work after hours or beyond the minimum required by their work agreements during with the district. As an extra activity, the use of Web2gether was highly affected.

4.2.4 *The Impact of the National Arena on Web2gether*

Local arrangements of design and participation are often affected by decisions made at the national arena. Such decisions are often inscribed on federal regulations, policies, and laws, and materialize in the institutional and work arenas as local incentive structures, time constraints, work requirements, and privacy and security regulations. Some of these attributes had direct implica-

tions for the design of Web2gether, such as privacy and security issues, whereas others are related to the motivations and legitimacy of using the technology as well as to the work structures and norms; whereas, others offer opportunities for the use of collaborative technologies others can turn their use into a potential source of litigations.

Teamwork – From Federal Requirements to Local Informal Collaborations. Special education teachers often work together in local teams with other professionals (related service providers and regular education teachers) to fulfill the needs of their students. These teams are required by US federal regulation, and are first formed when a student is requested to be evaluated for special education. Thereafter, the major goal of a team is to address the specific needs of each individual student based on his or her individual education plan (IEP). In this respect, the goals of the team's activities go beyond education to involve possible remediation of the limitations that affect education.

An IEP meeting is by law the legitimate forum for discussing protected health information (PHI) of students with some form of disability. The 1996 Health Insurance Portability and Accountability Act (HIPAA) regulates the transfer and collection of PHI between and within health care plans, clearinghouses, and providers. PHI includes all individually identifiable health information that is either created or received by a health care entity, and includes information about the past, present or future physical or mental health; the provision of health care; and payment for care. In allowing a child to be part of special education, parents are required to sign a consent form that allows the professionals involved in the IEP to share PHI with each other. These exchanges can solely take place during IEP meetings, which will be reported in a student's IEP. This regulation sets the boundaries of which PHI can be exchanged, and impacts directly the extent to which teachers can openly exchange experiences and support each other outside of this forum. Web2gether was designed to be a "safe" forum for teachers to form and develop personal support networks by exchanging personal experiences and stories. HIPAA prohibits any exchange of PHI, which is an essential part of the description of one's experience and needs, even among professionals, without prior parental consent. There is still the opportunity for IEP teams to make use of private sub-communities on Web2gether that is yet to be further explored and utilized.

Parents' Participation and Privacy Issues. Six months after the initial deployment of Web2gether in schools, we decided to explore the challenges and opportunities of bringing parents in to participate on site. We realized at that point the barriers to the adoption of the system by special education professionals in the district, due primarily to the lack of incentive structures and teachers' motivation to use the system as a collaborative tool, as previously described. In contrast, parents are likely to be highly motivated to explore new grounds, particularly due to their personal and emotional bonds to their children. Parents also have different perspectives and expectations regarding their children's needs, abilities, and future that often motivate them to experiment with novel ideas. This difference became a source of tension between teachers and the district. Although these groups have similar goals regarding the children, namely to help and support them, their somewhat distinct perspectives, expectations, and experiences often lead them to different solution paths that can potentially conflict. We are yet to analyze all issues concerning

parents' participation on Web2gether, but this initial attempt to bring in parents has already exposed important issues on privacy and collaboration between these two groups.

In contrast to teachers, parents are free to exchange experiences and stories about their children in their search for support and help. By law, parents can also go to court and request disclosure of any information that might have been exchanged between teachers about their children. In fact, teachers are required to ask first for parents' consent before exchanging any PHI about their students with any other professional outside the IEP boundaries, regardless of the communication medium. The privacy regulations in addition to teachers' own experiences or colleagues' experiences with litigations become a major barrier to the openness we initially envisioned.

Regulations and their impact on collaboration. Although the primary goal of special education is to provide students with disabilities specialized instructional and educationally related services, within the general education or in special education classrooms, the actual work revolves in part around the creation and review of each student's IEP and its fulfillment. The IEP is often regarded as the cornerstone of the Individuals with Disabilities Education Act (IDEA), which was created to ensure educational opportunity for students with disabilities. It is a quasi-contractual agreement to guide, orchestrate, and document specially designed instruction for each student with a disability based on his or her unique academic, social, and behavioral needs. This ranges from use of a specific technology to help the student to learn (e.g., how to sum single-digit numbers) to applying evaluation tests as part of IEP paperwork in preparation for a meeting with the IEP team.

Every student in public schools who receives special education and related services *must* have an IEP. The IEP is a legal document that governs most of the activities and mediates most of the formal interactions among a diverse group of actors in special education. School districts must be in compliance with this document, which means that special education teachers are legally bound. It also mandates the involvement and coordination of a specific group of individuals, the IEP team: special education teacher, regular education teacher, an expert on the special needs of the student, school system representative, transition services agency representative(s) (as appropriate), parents, a person to interpret evaluation results, and the study (as appropriate). Due to its legal nature, the IEP tends to become a source of tension among those involved in the process. Such tension affects not only the way that IEP meetings are carried out and the outcomes thereof, but also the extent to which crucial information is shared among participants. For example, a parent's different expectations regarding a child's ability to use a certain technology may result in different viewpoints concerning the extent to which that document should promote the use of such a technology. When the differences are not reconciled in the IEP meetings, they are likely to create disagreements between the parents and the school that might be resolved only in court. With this in mind, school personnel often refrain from bringing to the table all the information they have.

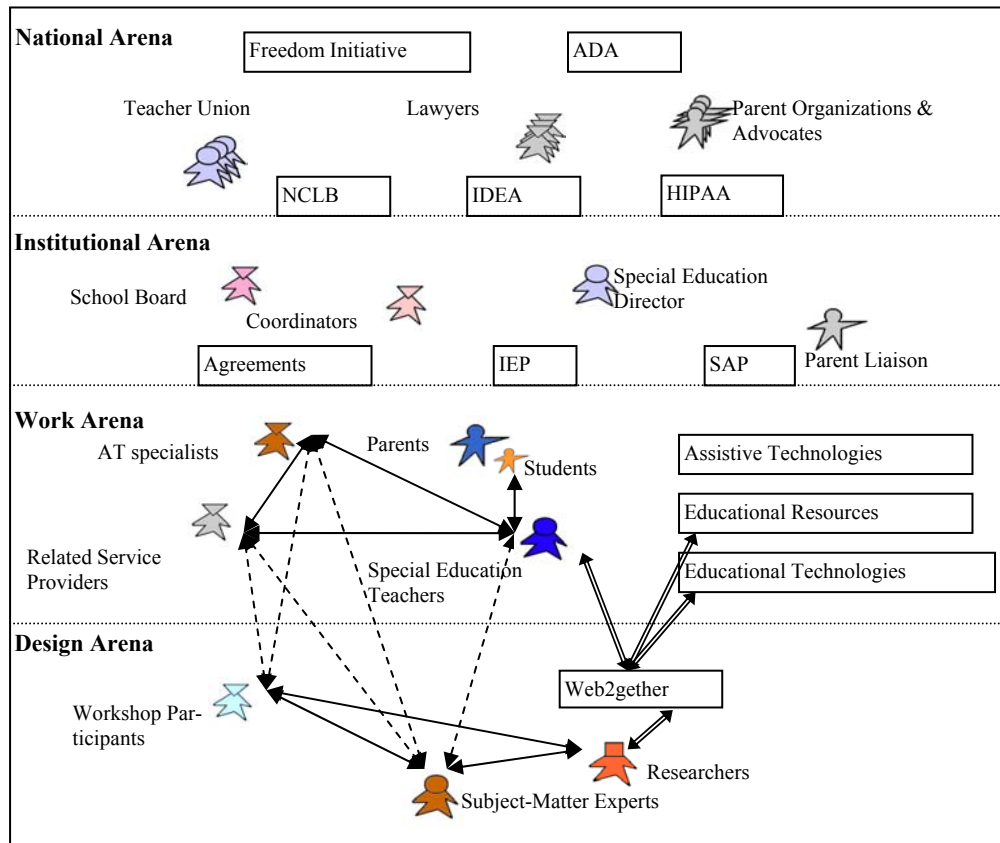


Figure 1. Arenas of Interactions and Actor Network Mobilized during PD Design Activities

5. ADOPTION OF WEB2GETHER – INTERPLAY AMONG THE ARENAS

Figures 1 and 2 depict simplified representations of the major actors, intermediaries, and networks mobilized during the participatory design activities and the introduction of Web2gether into the schools, respectively. They show the major actors involved in special education, as well as the major intermediaries active in different arenas. These intermediaries play determining roles in the activities that take place in the subsequent arenas, reaching down to the everyday work practices and education of students with disability. In Figures 1 and 2 the intermediaries include a set of federal regulations that establish specific standards and procedures. These standards and procedures in turn determine and mediate the practices and norms in the classrooms. The intermediaries represented in the figures are:

- Federal Regulations [Freedom Initiative, American Disability Act (ADA), Individuals with Disabilities Education Act (IDEA), Health Insurance Portability and Accountability Act (HIPAA), and No Child Left Behind Act (NCLB)];
- Legal Documents [Individual Education Plan (IEP)];
- Standardized Tests (SAP);
- Local Agreements (salary negotiation, ballot results);

- Technologies and Educational Artifacts (assistive technologies, educational technologies, Web2gether, lesson plans, educational Web sites).

Figure 1 shows the network that was mobilized or activated during the design activities. Note that a small number of actors was involved in the process. During the fieldwork and PD activities, we had an intense and unmediated interaction with a group of special education professionals whose participation was invaluable. They provided us with a deeper understanding of the socio-technical conditions of their work and the challenges and opportunities of using Web2gether in their classroom. This network was nevertheless limited to the extent that it did not mobilize actors beyond the design and work arenas. We therefore overlooked a number of sociopolitical constraints and challenges in the actual use of technology in the classrooms that were revealed when we moved from the design to the deployment phase of the project. Additionally, only a few intermediaries mediated the interactions, which in turn helped to draw an ideal or desirable, but somewhat unrealistic, picture of the work environment, these professionals' needs, and opportunities for the use of Web2gether.

Figure 1 shows the unmediated interaction among designers, the expert, and user representatives (solid-double-arrow lines). Both the user representatives and the expert are also related to other professionals in the work arena (dashed lines) due to their professional (and personal) relationships as well as work practices. These relationships are important in the sense that they represent

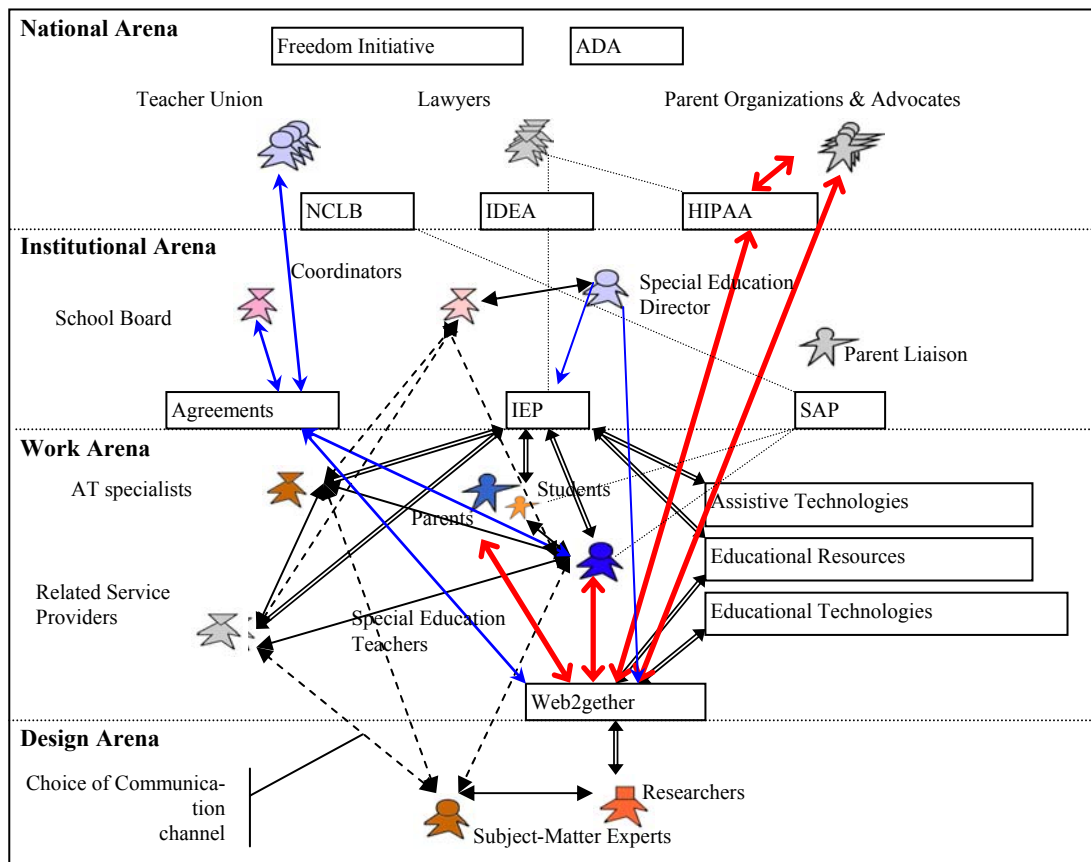


Figure 2. Arenas of Participation and Actor Network Mobilized during the Introduction of Web2gether in Schools

their professional and personal history—users’ situation model [15]—that are also present in the design activities and thereby affect their *translations*. Conversely, these interactions only partially or indirectly translate other users’ needs into design specifications and/or solutions. Web2gether, as an intermediary, also played an important role in the design, as it became a probe and an object-to-think-with that mediated the design activities and actual work practices, engendering thereby at the same time designers’ and users’ social norms and structures, expectations, values, and beliefs. Not represented in either figure are the networks that designers also bring to bear in PD activities that also intermediate the translations processes.

Figure 2 shows a more complete picture of the special education environment. It shows in part a new set of intermediaries and actors that were mobilized or came to the fore when Web2gether was introduced in the schools. This is still a partial picture, and focuses solely on actors and intermediaries that directly impacted the adoption and use of the system. This figure could get rather confusing if we tried to represent all possible interrelations, actors, and artifacts. Hence, we show only those that were previously described. For instance, the privacy issue that came out when parents got involved in the system can be seen through the relations that emerged among parents, parent associations and advocates, Web2gether, special education teachers, and HIPAA. This network can be best characterized as a tension that emerged due to the presence of parents on the site and potential privacy litigations. Another network that emerged was related to team-

work and collaboration in the classrooms. This network is represented by the relations among the intermediaries (the IEP document, assistive technologies, and educational resources) and actors (parents, teachers, and related service providers). Figure 2 also highlights the network that emerged during the salary negotiations between the school board and teachers’ union. This network had a direct effect on the use of Web2gether as it hindered teachers’ motivation for spending extra time on the site. Not represented are additional actors and intermediaries as well as relations that were introduced into the processes as we attempted to deploy the system.

The major difference between these two figures should not be necessarily attributed to completeness, however. It is important to understand that they in fact represent two distinct situations in which two different networks of actors and intermediaries were activated to address particular issues. On the one hand, during the participatory design activities, a more localized network was activated to help us explore the socio-technical conditions, challenges, and opportunities to the use of a collaborative technology in special education. On the other hand, during the introduction of Web2gether in schools, a broader network involving other arenas was mobilized, which helped in translating the sociopolitical issues on the use of collaborative and communication technologies in this environment. Moving from Design and Work Arenas to Institutional and Organizational Arenas, the *closure* achieved in the first moment, figure 1, was lost; the design became *opened* for

new interpretations and translations by the new powerful players, figure 2.

6. CONCLUSION

Design of collaborative and communications technologies is an iterative and exploratory process, and the outcomes are often difficult (or even impossible) to foresee due to the complexity of the relations between humans and their constructed artifacts, be they technology, power relations, social norms, policies, or structures. It can be best regarded as a dialectic relationship between “traditions and the transcendences” [6]. Often, traditions, or “how things are,” are simply taken as major barriers to innovations, or “how things ought to be.” In our research—and in PD as well, one may argue—we have taken a different perspective, and explored a tradition as a baggage of needs, knowledge, context, and previous experiences that users and designers bring to the table during participatory design activities, and eventually present in attempts to integrate the innovations into their work practices. A more recent line of thought in PD strives to create socio-technical conditions for unmediated participation of users, or those who own the problems [7], to capture such a baggage as truthfully as possible. Another line of thought acknowledges this, but argues that it is not sufficient. Similarly, we argue that participation is influenced by the sociopolitical arenas in which it takes place. The *translation* of users’ baggage is influenced by the socio arenas of participation due to the networks of actors and intermediaries that are mobilized in the process.

In this paper, we have presented a useful perspective to study complex design and adoption processes based on a relational analysis that integrates *arenas of participation* and *actor-network theory*. In particular, we showed that these networks will not only influence the *translations* inscribed in the design of artifacts, but they will also influence their adoption and use when users and the artifacts move through different arenas. In order to capture a complete picture of the practices these artifacts attempt to support, PD should go beyond the design arena, or immediate design participation, and explore the institutional and national arenas that will impact their actual use, that is, explore the politics of design. We think that there is an important message to be learned when we understand the relationships among different arenas and their influences on innovation, local practices and incentive structures. In the end, what we see moving back and forth between design and use of innovative artifacts is the artful and complex integration among actors, artifacts, agendas, and arenas, which may be simply *translated* into users’ local efforts supported by institutional norms, incentives, and structures, which in turn are established by national regulation and politics, reciprocally reshaping one another.

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