

# Information, Participation, and Collaboration Overload

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## A Design Trade-Off Analysis

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**Abstract.** Socio-technical environments grounded in end-user development (EUD) frameworks and supported by EUD technologies provide fundamental enabling conditions for cultures of participation. This paper argues and provides examples and evidence for the following claims:

- cultures of participation can cause (1) *information overload* (by generating substantially more information), (2) *participation overload* (by engaging people to act not only as passive consumers but as active contributors), and (3) *collaboration overload* (by requiring coordination activities between the numerous contributors);
- developments are needed (and some of them are described) that can *reduce these overload problems*;
- *design trade-offs* are created by these developments that should be carefully analyzed to gain a deeper understanding of the promises and pitfalls of different approaches.

## 1 Introduction

The digital age has created new opportunities for individuals and communities to engage and cope with information, participation, and collaboration.

**Information** represents externalized thoughts and knowledge. In oral cultures, information was communicated via speech. Literal cultures created the additional possibilities to use writing and reading in printed form. The digital culture added new possibilities for information capture (with sensors), creation (with computational environments), location (with search engines) comprehension (with multi-model representations), and sharing (with networks).

Participation transcends the absorption of existing information with a focus on actively contributing new or modifying information (e.g.: in the context of creating an artifact, framing and solving a problem, or making a decision). While information is a central concept of consumer culture (called “Read-Only (RO)” cultures by Lessig), active engagements and making contributions is the focus of cultures of participation

(called “Read/Write (RW)” cultures by Lessig) and it represents one of the core objectives and challenge of EUD [1], [2], [3].

Collaboration transcends participation by not only contributing something, but by coordinating individual contributions with the contributions of others to achieve a common goal. Collaborations connote relationships between people working together on shared tasks and shared problem spaces. They require a commitment to a common mission and control and authority are determined by different collaborative structures. The distribution of the individual contributions in collaborative activities can be differentiated along the following dimensions: (1) social distribution making activities more fun, more motivating, and by sharing the burden of coping with large problems (“getting the job done effectively and more quickly”); and (2) epistemological distribution by providing richer learning opportunities and suggesting new ways of thinking about problems (“bringing different views and opinions together”).

## 2 Developments Causing and Contributing to the Overload Problems

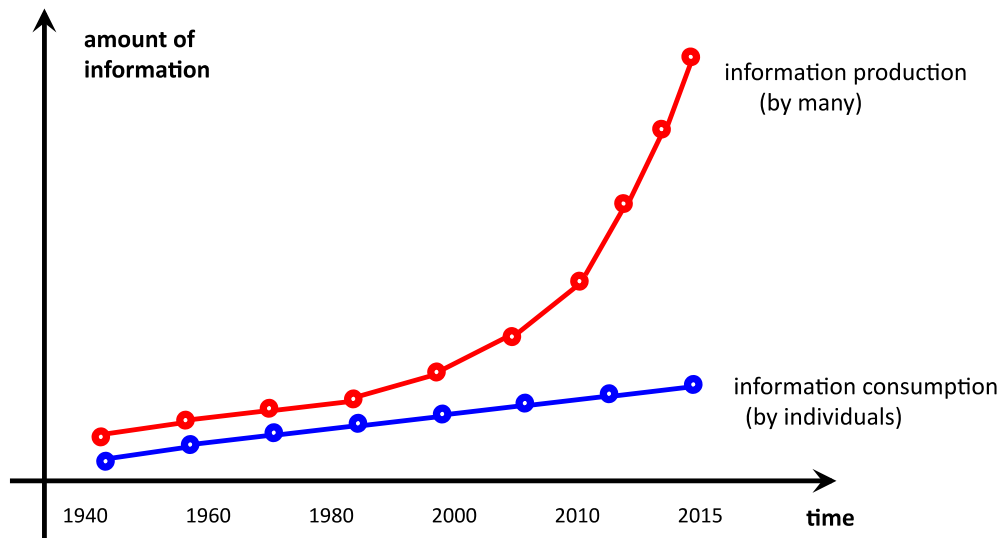
The growth of technology (based on Moore’s Law for computational power and Metcalfe’s Law for the value of networks) has provided the foundations for more information being available at our fingertips and more opportunities being offered for participation and collaboration.

In contrast to technological developments, the growth in human capabilities is limited: our neurons do not fire faster, our memory does not increase in capacity, and we do not learn or think faster as time progresses [4]. The mismatch between these developments has caused and contributed to information, participation, and collaboration overload problems.

**Information** overload exists for people in the following contexts:

- efforts keeping track what is going on in the world at large or in their circle of their friends, people are required to pay attention to emails, blogs, Facebook postings, and Twitter messages;
- opportunities for wanting to learn something, people have infinite resources to do so (including: the web itself, Wikipedia, TED lectures, MOOCs);
- challenges in coping with high-functionality environments (including: digital cameras to take photos, word processing systems to create papers and books, drawing applications to create graphical illustrations, programming environments to create software);

The exploding amount of information available is due to the dramatically increased possibilities for many more people to create and easily share information. Figure 1 illustrates that information *production* has increased dramatically (represented by the red curve) whereas people’s capabilities (represented by the black curve) are limited in keeping up with the demands of perceiving, sense-making, organizing, utilizing, and managing all this information.



**Fig. 1.** The causes of the information overload problem

The *participation overload* problem is caused by the numerous opportunities created in cultures of participation that people can be involved and take charge in numerous activities:

- they can check out their own groceries, check in by themselves at airports, make their own travel arrangements, take care of their banking needs, and write and typeset their papers; all of these activities contributing to a “Do-It-Yourself (DIY)” society;
- they are encouraged to vote in democracies, determine their own retirement plans, control their energy consumption, and contribute their ideas and insights to shared information repositories (such as Wikipedia, 3D Warehouse, open source environments, and Wikis created for all kinds of purposes);
- they are constantly requested to provide feedback about services (e.g.: for hotels, flights, repair shops, support provided via the Internet);
- they are empowered in EUD environments to modify, customize, or create the software they use or would like to have.

In our research, we have explored and contrasted two different approaches with linking participation, information production, and information sharing:

- MODEL-AUTHORITATIVE (“filter and publish”; see Figure 2) is based on strong input filters, resulting in relatively “small” information repositories, and requiring weak output filters; and
- MODEL-DEMOCRATIC (“publish and filter”; see Figure 3) is based on weak input filters, resulting in large and diverse information repositories, and requiring strong output filters to find relevant and reliable information.

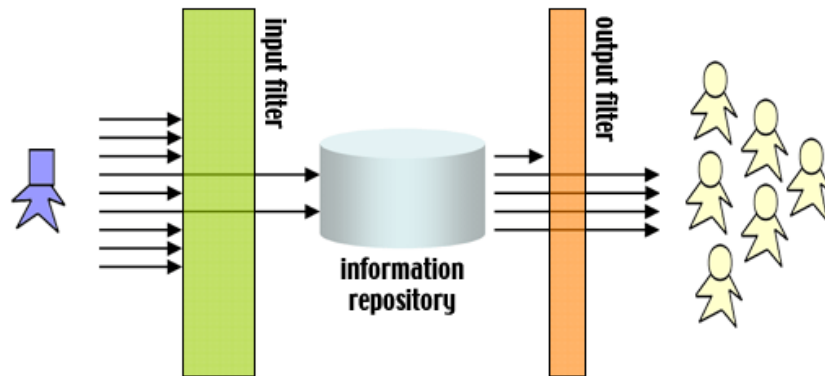


Fig. 2. MODEL-AUTHORITATIVE underlying Professionally Dominated Cultures

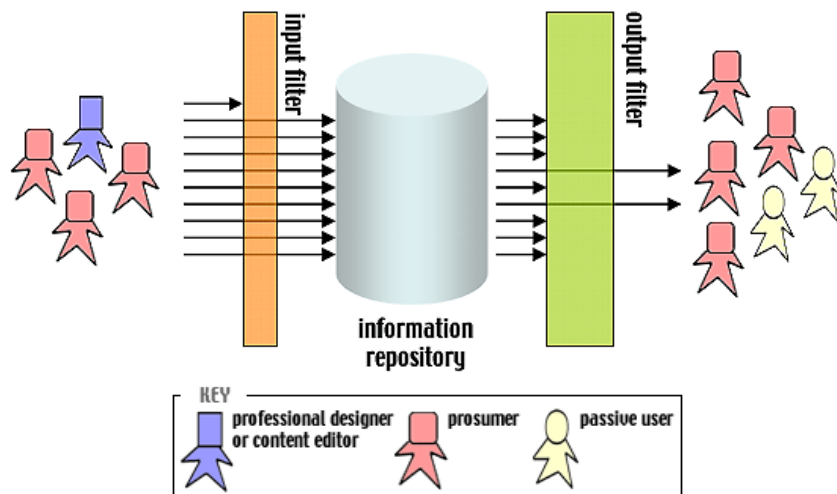


Fig. 3. MODEL-DEMOCRATIC underlying Democratic Design Cultures

Many of our research activities supporting MODEL-DEMOCRATIC have been focused on democratizing design [5] by supporting meta-design [6], and fostering social creativity by giving all people a voice [7] thereby creating new challenges and opportunities for research in EUD.

**Collaboration overload** problems were created by the numerous opportunities created by the Internet for people to engage in collaborative activities including:

- peer-support communities (e.g.: workers helping other workers, learners helping other learners with their problems in the context of community networks and forums) [8];
- engagement in collaboratories [9];

- organization of large, decentralized information spaces created by social production [10]; and
- crowdsourcing environments [11].

### 3 Developments to Address the Problems

While more information, more participation, and more collaboration can be highly desirable objectives, overload problems should be avoided. Following a few developments are described that can address these problems.

**Reducing Information Overload.** There are two basic modes to deal with information:

- *information access* systems (“pull-systems” in which users initiate processes with browsing and search methods) are designed with the assumption that users are aware of their information needs and that they know how to ask for them. The major limitation of information access systems is: if a user does not know that something exists, they will not ask and actively searching for it;
- *information delivery* systems (“push-systems”) provide information to users without explicit requests. Many information delivery systems (e.g.: Microsoft’s “Tip of the Day”, recommender systems, etc.) suffer from the problem that concepts get thrown at users in a decontextualized way. Despite the possibility for interesting serendipitous encounters of information, users find many of these features more annoying than helpful.

Search engines (such as Google) are the major tool against information overload in information *access* systems. Recommender systems may help in making search requests more targeted. Aggregator sites (for flights and hotels (e.g. Kayak), news (e.g.: Google News, Digg), and MOOCs) assist us in avoiding to be forced to search many sites and compare the results.

Information *delivery* systems pose greater threats for causing information overload problems. Context-awareness systems [12] (based on user models and task models) supporting personalization and task relevancy can filter out information that users may consider irrelevant.

**Reducing Participation Overload.** To actively modify or contribute something requires more effort than absorbing existing information. Methodologies and technologies that can reduce participation overload are:

- *meta-design environments* creating contexts at design time that support users as active participants in developing content at use time;
- *construction kits* reducing the demands on users by providing high-level building blocks for reuse, redesign, and remixing;
- *rich seeds* limiting the amount of additional functionality needed; and

- *domain-oriented environments* reducing the effort for users (being knowledgeable in certain domains) by allowing them to express themselves in their own language (thereby supporting human problem-domain interaction and not only human computer interaction).

Another important methodology to reduce the participation overload burden is to distribute the work to be done for creating modifications and extensions from individuals to a community (in which gardeners, power users, and local developers may emerge) [13].

**Reducing Collaboration Overload.** Several technology developments attempt to reduce the demands that collaboration can cause. Collaborative writing and reviewing is supported with version control and annotation systems. Meetings and webinars are facilitated by many computational environments. Structuring problems as nearly decomposable systems [14] reduces the demands for coordination as individuals can work on their own parts. On the social side, the burden of managing the additional demands generated by collaborative efforts can be distributed by creating additional roles (such as curators and facilitators) who are responsible for the coordination of the contribution of participants.

#### 4 Design Trade-Offs: Drawbacks Associated with Reducing Overloads

New developments such as cultures of participation, collective intelligence, and peer production should be viewed critically and not embraced as magical thinking. As argued in this paper, information, participation, and collaboration can create unique opportunities but they also can lead to overload problems. A careful analysis of *design trade-offs* [15], grounded in conceptual frameworks will protect people to suffer from delusions by only observing the gains and not being aware of the losses. It is important to keep in mind that many of the technological developments reducing the overload problems described in the previous section are complex artifacts by themselves and to learn and to use them may contribute to the overload problems.

The efforts to reduce the *information overload problem* are grounded in the basic assumption that “less is better”, but in certain contexts the opposite “more is better” may be the case [4]. The promises associated with context-aware systems are accompanied by the pitfalls that systems tailoring their services (including news and search results) to people’s inferred personal preferences and tastes, may cause unintended consequences that recipients get trapped in “filter bubbles” [16] representing a unique universe of information computed by algorithms. These algorithms create context awareness based on users’ previous actions and behaviors with the drawback that users do not get exposed to information that could challenge or broaden their worldview and that unexpected encounters with different topics and opinions are eliminated. Filter bubbles may lead to groupthink [17] with a loss of individual creativity and independent thinking, as well as a tendency to minimize conflict and reach a consensus decision without

critical evaluation of alternative ideas or viewpoints. To transcend these shortcomings requires to find the right balance between serendipity [18] and making information relevant to the task at hand [12] by designing interaction mechanisms that allow users to select their own personal, situation- and time-dependent best mix of these design trade-offs.

The *participation overload problem* can be analyzed with the concept of “libertarian paternalism” [19], an interesting design-trade-off discussed in behavioral economics and public policy. It advocates to explore middle ground as the choice between paternalism (being prescriptive) and libertarian (being permissive). Libertarian paternalism distributes control with nudges between choice architects (e.g.: policy makers in governments, designers, teachers, meta-designers) and users (e.g.: citizens, learners, end-users.). An overemphasis on paternalism (by establishing commands, scripts, workflow processes, requirements, or prohibitions) will reduce the participation demands for the users — but without the libertarian dimension the approach will pay no respect for the individual autonomy of users.

Another design-trade-off with respect to participation has been explored in our work on cultures of participation [1]. Participants can encounter two opposing problems:

- someone wants to be a consumer but is forced to be a designer;
- someone wants to be a designer but is forced to be a consumer.

The first problem often occurs in the context of activities that participants consider personally irrelevant and can be illustrated by do-it-yourself societies. With modern tools, humans are empowered to perform many tasks themselves that were done previously by skilled domain workers serving as agents and intermediaries. Although this shift provides power, freedom, and control to customers, it leads to a participation overload and will force people to act as contributors in contexts for which they lack the experience (which professionals have acquired and maintained through the daily use of systems) and the broad background knowledge to do the tasks efficiently and effectively. The second problem avoids participation overload but it deprives people to participate in activities that they find intrinsically rewarding and it prohibits them to modify systems to fit their needs (the main objective of EUD) [5].

The Internet has tremendously advanced the opportunities for collaboration and social production [10]. Collaboration in cases where it is based on *collectivism* involving coercion and centralized control and where it requires additional work (without benefiting from it) can and will be perceived and experienced by participants as *collaboration overload* [20] whereas *collective action* based on self-election, self-interest, and distributed coordination can contribute positively towards creating cultures of participation.

## 5 Conclusions

Technology is a catalyst and will play an important role for future developments in the digital age. While the growth of technology is certain, the inevitability of any particular “future” is not. A framework focused on design trade-offs will be important and helpful

to understand the promises and pitfalls associated with information, participation, and collaboration.

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