SHARING DIGITAL RESOURCES: PLATO AND THE EMERGING ETHICS OF SOCIAL COMPUTING

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Abstract

This paper presents findings from our ongoing research on the genesis and evolution of early social software on one of the most influential platforms in social computing: PLATO, a pioneering educational and social computer platform developed at the Computer-based Education Research Laboratory (CERL) at the University of Illinois at Urbana-Champaign (UIUC) in the 1960s and 1970s. Our research addresses the evolution of ethics in the emergent PLATO system. It examines the development of norms and establishment of areas of ethical concerns among developers and users of PLATO. Our hypothesis is that the social construction of norms and ethics occurs within the imaginary and real tensions among and between different actors of the sociotechnical system (students, teachers, system administrators). PLATO, as a prototypical participatory computer platform, provides a significant, early view of the extent to which the ethics of digital resources usage is socially and discursively constructed. This is particularly vivid in the discourse underlying the classification of system uses and applications between "disruptive" and "valuable". As part of this project, we undertook digitizing archives of print-outs of the "general questions" forum used both by developers and users of PLATO IV from 1972 to 1976. A rhetorical analysis allowed us to identify a long-standing controversy about games and recreational uses of digital resources originally meant for other purposes. Considered disruptive by some, innovative and "functional" by others, these unanticipated uses paved the way to social computing and ultimately became the new "norm".

1. Introduction

The development of norms and establishment of areas of ethical concerns among developers and users of PLATO, a pioneering educational and social computer platform developed at the Computer-based Education Research Laboratory (CERL) at the University of Illinois at Urbana-Champaign (UIUC) in the 1960s and 1970s, provides unique insight into the history of the social construction of participatory computing.

An interesting aspect of PLATO is that it was not originally conceived of as a computer-mediated communication (CMC) platform or device, but was intended to serve as an automated computer-based education system. Particularly interesting during the period 1972 to 1976 are the ethical discussions as the PLATO system was reframed as a social platform used for educational purposes. What conditions were particularly fought over during its transformation? What might we learn from the rhetoric and discourse

surrounding debates (among developers and between developers and users) about the genesis of the social elements of this platform, and how might those inform current understanding of participatory cultures within digital media platforms? The notions of "proper use" and "disruptive use" revealed particularly useful information with which to identify the controversies that led to formalizing—and inscribing in the socio-technical device—a set of principles revolving around the tension between limited computer resources (processing unit, memory, disk space, terminals, etc.) and playful, creative uses. Along with the issue of authentication and monitored access, the most salient, ongoing controversy was about an unanticipated use of the system: gaming.

First, we present the case under study, namely the PLATO socio-technical device. Then, the theoretical perspective—rooted in Science and Technology Studies—is introduced, along with our main research questions. The next section describes our methodological approach and the material analyzed. We then proceed to present the preliminary findings of our study, before we end with a few conclusive remarks.

2. Case study: PLATO

Among the platforms that have played a seminal role in the emergence of computer-mediated communication (CMC), the PLATO system holds a special position both for its precursory status and for its legacy. Designed in the early 1960s by Donald Bitzer at the University of Illinois at Urbana-Champaign (UIUC), PLATO (Programmed Logic for Automated Teaching Operations) is generally considered to be the first computer-assisted learning system to be widely disseminated (Van Meer, 2003). Avant-gardist due to its fairly advanced user interface for the time—fast response, graphical touch screens, quality sound—it had a profound influence on many computing developments, including games, groupware and, of course, online learning environments.

Originally developed on a ILLIAC computer and funded by U.S. military agencies—as was ARPANET a decade later—PLATO went through a series of versions throughout its first decade of existence before it became the multiuser, multiterminal system that constitutes our object of study (see table 1). A turning point in its technical evolution is the establishment in 1967 of the Computer-based Education Research Laboratory (CERL) at the heart of the University of Illinois campus. Funded by a National Science Foundation (NSF) grant, and with Don Bitzer at its head, CERL would prove a very dynamic development environment, both as an infrastructure and as an organization, as reflected in the rapid expansion of PLATO beyond the premises of the University of Illinois main campus. "In 1975 PLATO IV served 146 locations from the University of Illinois (26 on campus), 10 elementary schools, 3 high schools, 6 community colleges, 22 government-related installations, 31 medical sites, 32 colleges and universities and 16 at other off campus locations" (Van Meer, 2003). With Control Data Corporation (CDC)'s acquisition of PLATO commercial rights in 1976, the system started to diffuse further to private corporations and foreign university campuses (notably in South Africa and Canada). By 1980, Control Data had invested 600 M$ in PLATO, but failed to turn it into a viable commercial product (Van Meer, *ibid*).

Year	*Version*	*Simultaneous users capacity*	*Other features*
1960	PLATO I	1	TV display.
1961	PLATO II	2	Time-sharing capability.
1963-66	PLATO III	20	General purpose programming language (TUTOR).
1972	PLATO IV	300+	Plasma flat-panel screens, "touch" screen option, natural language interface...

Table 1. PLATO system evolution (based on Van Meer, 2003).

The offsprings of PLATO in software development are plenty, though their connection with the pioneering platform is little known. One of the possible reasons for this obscurity is that successful programs were not merely "ported" to other platforms: they would be copied, in whole or part, or the underlying ideas would serve as inspiration for applications on other computer systems or platforms. That dissemination occurred thanks to the migration of PLATO contributors to other loci of digital technology development, including large computer corporations (as Control Data and IBM) and the Silicon Valley. In that sense, PLATO can be considered as a "school" for the pioneers of educative and collaboration-oriented computing that has become known as "social computing".

This is precisely what happened with "Notes", a message board application for PLATO IV, that Ray Ozzie, one of its developers, would use as a blueprint for Lotus Notes, a well-known groupware platform, after he was hired by the software giant (Woolley, 1994). Similarly, *Flight Simulator*, a famous Microsoft game, was originally developed on PLATO as *Airfight*. PLATO was also the cradle of several chat programs and interactive online games (Woolley, 1994 ; Dear, 2002). One of them is Talkomatic, which foreshadows current chat systems in many ways, notably by its introduction of the "channel" concept (see Latzko-Toth, 2010). Among forerunners of modern multiuser online games, PLATO's *Empire* stands out as a milestone. The "games controversy" that is at the heart of our case study probably stemmed from the unprecedented success and addictivity of this program among younger PLATO users (Silberman, 1997), along with others like *Avatar*, *Moonwar* and *Star Trek.*

Why did many of the elements of CMC (including social networking) that later came to be hallmarks of Internet use seem to spontaneously arise on PLATO? One element of an answer is that PLATO had an open architecture inviting users to become co-designers of the system. Elements were developed, and, importantly, nurtured, as a need was seen and use grew. But it appears that the technical openness of PLATO was also mirroring CERL's organizational culture that, contrary to most university computer research facilities of the

time, encouraged participation from a wide array of people, including university and even high-school students. In other words, the ethos of the human environment within which PLATO arose and operated is an important element in our consideration.

A key element of PLATO openness as a software platform was its powerful yet relatively simple programming language: TUTOR. It was originally developped in 1967 by Paul Tenczar, a biology graduate student at UIUC who would become a central figure of PLATO development (Woolley, 1994). Different categories of users existed on PLATO, which would offer different sets of functionalities according to the "status" under which the user would be logged on: "student", "teacher", "author" or "system". The latter was the equivalent of "system operator" (SysOp) and would be reserved to PLATO developers and administrators. The first two categories are self-explanatory and would allow the system to make the difference between the person taking a class, and the person supervising it. The three categories replicate existing institutional categories of actors in any educational organization. The "author" status was not reserved for any specific category of actors. It was granted to virtually anyone willing to contribute to the corpus of PLATO programs, know as "lessons". While a typical "lesson" would be composed of a set of sequential "units" of knowledge/skills to be learnt and practiced by students, the flexibility and versatility of TUTOR allowed lessons to drift quite far from this typical sequential schema. It made possible a wide array of creative programs, including purely recreational ones, as was said before, but also communication and collaboration services that became essential to the system development.

"Notes" was one such service. Formally released in August 1973, it was originally coded by David Woolley—then a 17-year old university student—as a group messaging system for users to report bugs to the "system staff" (Woolley, 1994). The program was named after the very basic "notes" files it was meant to replace—simple text files edited collectively; when they reached their full capacity a new file would be created, and its number incremented. Having evolved considerably through the years (most like the PLATO system with which it grew), PLATO Notes eventually accommodated a wide range of topics besides the original three categories: System Announcements, Help, and General Interest. With the geographical expansion of PLATO far beyond CERL physical premises, "General" Notes became the online space where users and developers would meet and discuss issues of all kinds regarding the system. A partial archive of their content formed the main source of data for our research.

3. Theoretical context and research questions

This study is part of a larger research project investigating the interplay between innovations in social computing and the social dynamics around the digital artifacts being produced. Our theoretical approach crosses digital media historiography (Gitelman, 2006 ; Park, Jankowski, & Jones, 2011) with constructivist currents in sociology of innovation. A central idea in latter approaches is that technological innovations emerge from a complex dynamics of "co-construction", where artifacts, developers and users are interacting and mutually shaping each other (Boczkowski, 1999 ; Bardini 2000; Oudshoorn & Pinch, 2003; Latzko-Toth, forthcoming). This process involves the "interpretive flexibility" of the artifact, that is, its openness to various projections of meaning, and consequently, its

adaptability to different uses imagined by different actors (see Pinch & Bijker, 1987). Also pivotal is the role of "boundary objects", entities existing at the intersection of different communities of practice, with a distinct signification for each of them, and that help heterogeneous actors to collaborate (Star & Griesemer, 1989).

Our reflection draws on a growing body of scholarship showing that, particularly in the context of digital media, boundaries between designers and users are blurred, and users play an active part in the construction of software-based technological systems (Hippel, 2001 ; Tuomi, 2003 ; Neff & Stark, 2003 ; Boczkowski & Lievrouw, 2008). Combining Hippel's work on user communities (Hippel, 2001) and Tuomi's concept of "network of innovation" (Tuomi, 2003), we suggest that CERL members and PLATO users of the 1970s formed a *community of innovation*, that is, a community of practice gathering users and developers, and focused on the creation, improvement, and expansion of an artifact or a set of artifacts within articulated ethical frameworks that were always contested. The discourse and arguments surrounding use of shared and limited resources, long-range vision for the system, and short-term needs reveals much about the intertwined formation and re-formation of community norms in an innovation-driven online community.

Communities of innovation engaged in the design of a digital artifact that is also a communication and a collaboration tool for the community resemble what Bolici & Virili (2009) call a "design network", or a "recursive public" (Kelty, 2008)—except that recursive publics are generally scattered and loosely interacting. But the notion of recursivity aptly captures the circular process by which a public constitutes itself through a socio-technical device it develops. Since the device may be seen as a substrate for its own development, we propose to call *recursive artifact* a software-based product that mediates the social interaction around its own design process. An interesting consequence is that this mediation affects the design process. As observed by Bolici & Virili (*ibid.*), there is a mutual influence between the design network and the "network artifact" it produces, in a co-evolutive dynamics.

The discourse about PLATO occurred *on* PLATO and engaged users and developers not only in discourse but also in development. Indeed, the distinction between a user and a designer was often difficult to make. From that perspective, our study shows an interesting "co-evolution" of PLATO as an artifact and PLATO as a community (Woolley, 1994), making it a prototypical recursive artifact. In this study, we were interested in the emergence of ethical norms related to system usage, notably regarding the problem of digital resource sharing—in the context of their scarcity, on one hand, and the rapid growth of the number of users, on the other hand. What we call "digital" resources in the case of PLATO consists of processing time, storage/memory space, and terminals. On PLATO IV, a particularly disputed type of memory space was ECS (*extended core storage*). Exclusive to Control Data mainframe time-sharing computers, ECS was a kind of fast external memory add-on allowing the system to emulate a larger central memory by temporarily storing users' "lessons" while it was serving other users. "ECS space" was a crucial resource since once the system ran out of it, the system would terminate some programs in order to keep working. Thus, while PLATO could accommodate a large number of users at the relatively acceptable cost of slowing down, it was restricted in the volume of code and data it could manage at a time. Our main research question stems from these considerations: *How did*

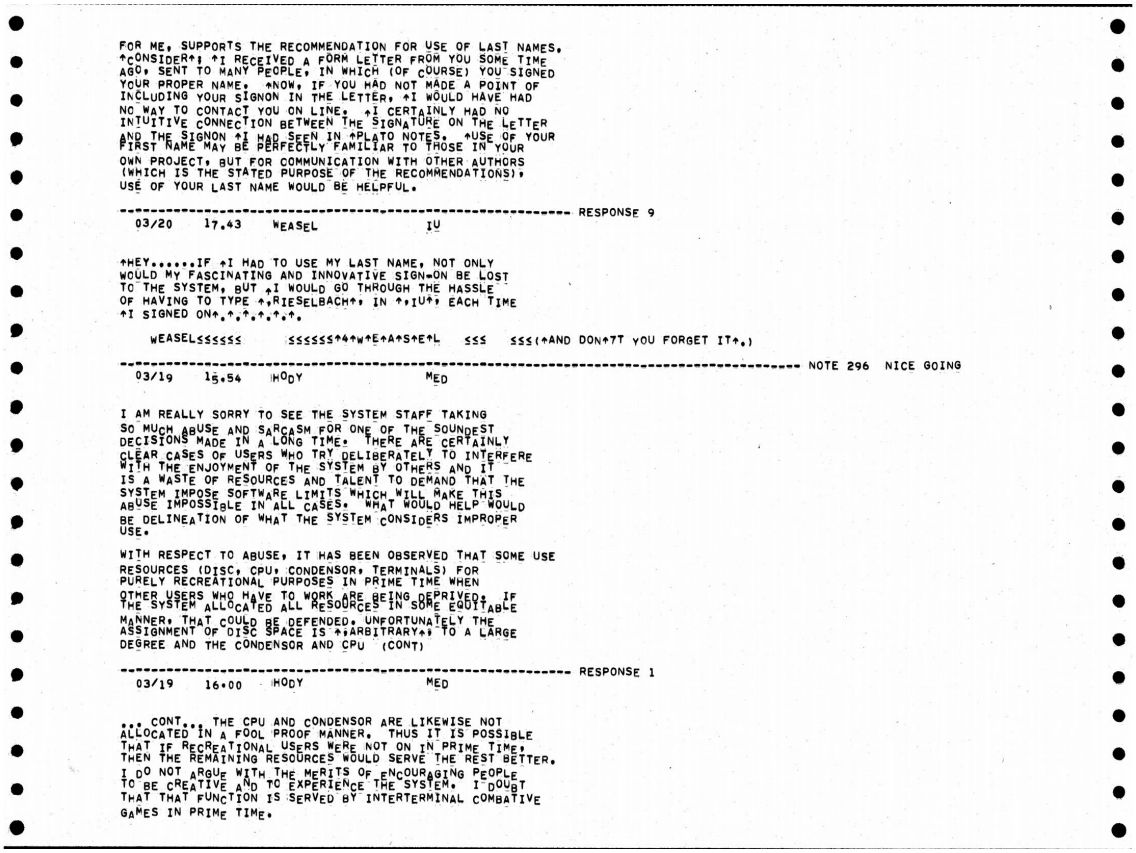
competing views on the purpose of the system and the value of its applications interplay in the collective negotiation of legitimate uses and an ethics of resource allocation?

The normative notion of "legitimate use"—uses deemed compatible with the purpose of the system—is opposed to the notion of "disruptive use". *Disruption* can be understood as an "interruption to experience". Drawing on this concept borrowed from John Dewey, Bowker & Star (1999: 295) argue that it is related to the legitimacy of actions and actors within a community of practice, since "illegitimacy appears as a series of interruptions to [the expected] experience". Therefore, what is at stake in the ethical concern regarding resource sharing is what is expected as a user experience of PLATO by legitimate members of the community of innovation. Which leads us to a more specific research question that we will address in this paper: *How did actors of PLATO development discursively construct disruptive and valuable uses of the system?*

4. Methods and data

Our case study relies on different methods of inquiry, including one of the two author's first-hand experience with the system (Steve Jones). We also did observation, participation and interviews with PLATO early developers and users at the 50th PLATO anniversary symposium ("PLATO@50") held in June 2010 at the Computer History Museum in Mountain View, California. These interactions with the actors (and artifacts available at the museum not only on display but also for use) of PLATO history, along with additional mediated interactions—notably through the *Talkomatic* native PLATO chat program, using an Internet-based emulator—allowed us to "fill the gaps" and refine our interpretations of the documents collected at the University of Illinois Archives. Among them, three boxes (3.0 cubic feet) of paper consisting of print-outs of "General Interest" Notes files. It represents approximately 7,500 pages of text, first scanned as images (see fig. 1) then re-keyed due to technical issues preventing us from performing optical character recognition (OCR). They cover a period starting in October 1972—a date roughly corresponding with the debut of PLATO IV—and ending in June 1976, when David Woolley was asked to print the files before they were erased from the system to free disk space. Files are partitioned in three subsets corresponding to different stages of Notes development. Following University of Illinois Archives nomenclature, the 68 files (plus one addendum) in our dataset are referred to as follows: LN01-LN19 (October 1972 to August 1973); ON01-ON09, ON18-ON41 (January 1974 to December 1975); PN01-PN16 (December 1975 to June 1976).

A rhetorical analysis was performed on those archived discussions between early developers and users of PLATO, using a QDA software as a text processing and coding tool. This allowed for an inductive approach to the material, letting analytic categories emerge through coding. Considering the amount of material, we turned to plain text searches on keywords to focus our attention of relevant messages. We would then iterate the process once a new topic or significant word was identified. This is how we realized that games and gaming were a recurrent and controversial theme throughout the covered period.



FOR ME, SUPPORTS THE RECOMMENDATION FOR USE OF LAST NAMES.
↑CONSIDER↑: ↑I RECEIVED A FORM LETTER FROM YOU SOME TIME
AGO, SENT TO MANY PEOPLE, IN WHICH (OF COURSE) YOU SIGNED
YOUR PROPER NAME. ↑NOW, IF YOU HAD NOT MADE A POINT OF
INCLUDING YOUR SIGNON IN THE LETTER, ↑I WOULD HAVE HAD
NO WAY TO CONTACT YOU ON LINE. ↑I CERTAINLY HAD NO
INTUITIVE CONNECTION BETWEEN THE SIGNATURE ON THE LETTER
AND THE SIGNON ↑I HAD SEEN IN ↑PLATO NOTES. ↑USE OF YOUR
FIRST NAME MAY BE PERFECTLY FAMILIAR TO THOSE IN YOUR
OWN PROJECT, BUT FOR COMMUNICATION WITH OTHER AUTHORS
(WHICH IS THE STATED PURPOSE OF THE RECOMMENDATIONS),
USE OF YOUR LAST NAME WOULD BE HELPFUL.

---------- RESPONSE 9
03/20 17.43 WEASEL IU

↑HEY.....IF ↑I HAD TO USE MY LAST NAME, NOT ONLY
WOULD MY FASCINATING AND INNOVATIVE SIGN-ON BE LOST
TO THE SYSTEM, BUT ↑I WOULD GO THROUGH THE HASSLE
OF HAVING TO TYPE ↑↑RIESELBACH↑↑ IN ↑↑IU↑↑ EACH TIME
↑I SIGNED ON↑.↑.↑.↑.↑.↑.

WEASELSSSSSS SSSSSS↑4↑W↑E↑A↑S↑E↑L SSS SSS(↑AND DON↑7T YOU FORGET IT↑.)

---------- NOTE 296 NICE GOING
03/19 15.54 HODY MED

I AM REALLY SORRY TO SEE THE SYSTEM STAFF TAKING
SO MUCH ABUSE AND SARCASM FOR ONE OF THE SOUNDEST
DECISIONS MADE IN A LONG TIME. THERE ARE CERTAINLY
CLEAR CASES OF USERS WHO TRY DELIBERATELY TO INTERFERE
WITH THE ENJOYMENT OF THE SYSTEM BY OTHERS AND IT
IS A WASTE OF RESOURCES AND TALENT TO DEMAND THAT THE
SYSTEM IMPOSE SOFTWARE LIMITS WHICH WILL MAKE THIS
ABUSE IMPOSSIBLE IN ALL CASES. WHAT WOULD HELP WOULD
BE DELINEATION OF WHAT THE SYSTEM CONSIDERS IMPROPER
USE.

WITH RESPECT TO ABUSE, IT HAS BEEN OBSERVED THAT SOME USE
RESOURCES (DISC, CPU, CONDENSOR, TERMINALS) FOR
PURELY RECREATIONAL PURPOSES IN PRIME TIME WHEN
OTHER USERS WHO HAVE TO WORK ARE BEING DEPRIVED. IF
THE SYSTEM ALLOCATED ALL RESOURCES IN SOME EQUITABLE
MANNER, THAT COULD BE DEFENDED. UNFORTUNATELY THE
ASSIGNMENT OF DISC SPACE IS ↑↑ARBITRARY↑↑ TO A LARGE
DEGREE AND THE CONDENSOR AND CPU (CONT)

---------- RESPONSE 1
03/19 16.00 HODY MED

... CONT... THE CPU AND CONDENSOR ARE LIKEWISE NOT
ALLOCATED IN A FOOL PROOF MANNER. THUS IT IS POSSIBLE
THAT IF RECREATIONAL USERS WERE NOT ON IN PRIME TIME,
THEN THE REMAINING RESOURCES WOULD SERVE THE REST BETTER.
I DO NOT ARGUE WITH THE MERITS OF ENCOURAGING PEOPLE
TO BE CREATIVE AND TO EXPERIENCE THE SYSTEM. I DOUBT
THAT THAT FUNCTION IS SERVED BY INTERTERMINAL COMBATIVE
GAMES IN PRIME TIME.

Figure 1. A sample of PLATO Notes original print-outs.

5. Preliminary findings

To date our analysis of this large corpus of material confirmed that games and other "non-educational programs" were at the midst of an ongoing debate over proper allocation of resources within the PLATO community of innovation. In fact, they were epitomizing a broader debate over the *purpose* of PLATO, highlighting the interpretive flexibility of the artifact:

> I must point out that this is an experimental teaching computer, and its function is primarily that of an educational asset. During the day, there are so many authors and students, that the terminals and computer time are limited to those people who are using the computer *as it was designed, for educational purposes*. (File LN09, 3/28/1973; our emphasis)

> The CPU and condensor are likewise not allocated in a fool proof manner. Thus it is possible that if recreational users were not on in prime time, then the remaining resources would serve the rest better. I do not argue with the merits of encouraging people to be creative and to experience the system. I doubt that that function is served by interterminal combative games in prime time. (File ON24, 3/19/1975)

> The machine should (given resources) be available to all students, not only those in specific courses, and for all purposes, not only lessons. *Just like a library*. The catch is the "given resources". If PLATO can allocate resources sensibly, [...] it should. (File ON26, 4/08/1975)

CERL authorities had a "freedom of authorship" policy (derived from notions of "academic freedom" common at U.S. colleges and universities and early hacker ethos) that encouraged exploratory and creative practices on PLATO, including purely recreational ones. But that ethos had to deal with the scarcity of key digital resources as well as non-digital ones (e.g. labs operating hours, system staff labour…). Thus, games and other programs from "unsupervised authors" were competing with other applications for resources, including terminals, ECS space, and peak hour time slots:

> The objection is not to "game" lessons per se but to recreational use of terminals and site ecs when others have pressing needs for these resources. (File ON09, 5/13/1974)
>
> why abuse [the system] with games during prime time, when games eat away at precious, valuable ecs space, when this time is the ONLY time some authors can work... ? (File ON21, 2/04/1975)
>
> unsupervised authors use the system to[:] harass other authors[;] occupy space better used by students[;] play games, often without regard to shortage of cpu and or terminals[;] ask frequent and bizarre questions in note files[;] generally exhibit some of the worst characteristics of mankind (File ON31, 6/18/1975)

The latter quote clearly illustrates the idea of *disruptiveness* that was associated with gaming. Games as disrupting the expected experience of PLATO were a recurring theme of user complaints sent to "system people" who had the power to terminate user sessions if they wished, but carefully weighed decision to do so and rarely used such power:

> This is another frustrating day on the system. All around me are students playing games and not being deleted. (File LN19, 7/24/1973)
>
> Room 165 CERL is a classroom, not an arcade. I can't believe you weren't aware of the crunch for terminals when you entered the games. (File PN11, 4/20/1976)
>
> children of unspecified ages spend their days at cerl playing games. [...] concomitant with playing is the issuing of loud, disgusting noises [...] when the non-educational use of the [...] system interferes with serious work, SOMETHING HAS TO BE DONE. (File ON34, 8/20/1975)

The following examples show how members of the community of innovation discursively construct what constitute "'serious' and 'non-serious' usage", legitimate and illegitimate uses of PLATO, or the "value" of software contributions:

> We should be careful to know the difference between "serious" and "non-serious" usage. The usual game-playing that at times takes place should not constitute "serious" usage [...] (File ON02, 1/23/1974)
>
> why would you want to play games when there are so many other neat things to do on Plato? (File LN12, 4/18/1973)
>
> How come you ********* keep stealing the games from this ****** computer. They're probably the only thing of value or interest on this machine. (File LN09, 3/27/1973)

As we can see from above examples, the technical problem of sharing resources was framed as an ethical issue. And the notion of "education"—a boundary object between teachers, system developers, and students—served as a guiding principle to sort out what was and what was not good resource allocation. Thus, "theories" of education could be invoked either to ban games, or conversely, to justify their presence on the platform:

> the entire idea of PLATO is to show that learning need not be the rote methods in use before. Most "game" lessons [...] include some element of education in them. (File LN06, 1973/01/22)

> Systems people must realize the educational benefit of certain games both to those using them and to those (especially new) authors writing and coding them. If system capacity permits, certain game playing and games authoring should be considered educationally as vital as more discipline oriented lesson viewing and authoring. (File ON05, 1974/02/28)

Games were also seen by some as being beneficial to PLATO (and therefore to its users) because they were pushing the system to its limits. As a result, they offered to PLATO designers (and their sponsors) a "benchmark" of the system's technical possibilities. Furthermore, they were a precious aid in promoting PLATO and its cutting-edge technology:

> some of the games are truly our best show cases. (File ON08, 4/08/1974)

Therefore, education—or "educationality"—was not the sole principle invoked in the ethical debate on resource sharing. *Functionality* was another one, clearly articulated here:

> The question of redundant computation on the system is a more rational way of dealing with the REAL problem than making a neurotic attack on some symbolic organism called 'games'. It seems to be a matter of system engineering to *utilize the available resources profitably*. [...] Get rid of lousy lessons and programs that are less functional than the computer stuff they consume... entertainment and education are both functional, redundant computation and idle time are not. (File ON21, 2/05/1975; our emphasis)

And the immediate reply to the previous note can be seen as a summary of the whole argument:

> When questioning the relative importance/unimportance of any one lesson or group of lessons, recall the REAL purpose of a "lesson,"—something to instruct, or help; or, because this is an important part of education, to entertain. I think no one could *reasonably* argue for something which taxes the system at the student's expense; nor can we simply group an entire category of lessons into the (somewhat overworked) status of "game". You can almost always find the same people saying the same things every time this comes up—one faction which is here to play, and another which is (sometimes unsuccessfully) attempting to run large classrooms of students on what was until recently a VERY tight system (File ON21, 2/05/1975).

6. Conclusions

Our case study of PLATO illustrates how the notion of "legitimate use" and "device purpose" are relative and constructed. Disruptive uses must be seen as normative, ethical constructs that can evolve when the context—e.g. resources available—changes. These constructs are also coded into the system not only in regard to resource allocation and use but also in the monitoring of allocation and use and in the hierarchical construction of users that embeds values and power within it. Thus, despite being marginalized in the first decades of the computer age, playful and social uses of early digital resources paved the way to modern social computing. They ultimately became the new "norm", giving birth to two digital media industries: online games and social media.

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