Between Communication and Computer Science: an experience in software development for journalistic production management[1]

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Abstract: This paper describes the experience of a group of researchers from Universidade Federal de São Carlos - UFSCar, in the Brazilian State of São Paulo, proposing the development and improving of a free software focused on media production. Called Integrated Communication Support System, it was created in UFSCar and adopted in several other universities through Brazil. This report is expected to help promoting some reflection about the relationship between Communication and Computer Science established around development, research, and thinking of Information Technology and Communication. Emphasis is given to the challenges of applied research in this scenario.

Keywords: Information Technology and Communication; Software Development; Computer Science; Journalism; Cyberculture.

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1. Introduction

Is it possible to reason about Journalism without thinking about Technology? Certainly not, as the journalistic practice itself depends on a number of technologies for it to become effective, including the communication media themselves in their own diverse historical relations, going from the Gutenberg's printing press until the Internet, and through the newspaper, which even today influences the way we do Journalism.

Contemporaneously, though, the debate around Journalism and Technology has been boosted by the very nature of the technological innovation as a characteristic of a society where the consumer goods industry has to show new proposals at each and every instant. That innovation model is so fast we can even frame it into Bauman's proposition (2001) of "liquid" modernity, after all the liquidity, the malleability and the lack of a shape can also be considered characteristics of the modern Information Technology and Communication (ITC) industry.

Amidst this environment of technological innovation, how to promote a journalism in sync with all the new interactive possibilities so characteristic of the new media? How to contribute with technology design? How to rethink the journalistic practice and its own language? Those are some of the questions that highlight the challenges of applied research[4] on institutions focusing their research on Communication and Journalism. Aiming to contribute to this debate, this paper describes the experience of a group of researchers from Universidade Federal de São Carlos (UFSCar) in Brazil, and how they proposed, developed and improved a free software focused on media production. It is called Integrated Communication Support System (Sistema de Apoio à Comunicação Integrada – SACI) and it was already adopted on several universities throughout the country, as shown on topic 4. By describing that experience, we hope to promote some reflection around the relationship between Communication and Computer Science established around development, research and the way of thinking about ITC's. Moreover, special emphasis is given to the challenges of applied research in that scenario.

[4] Here we use the term "applied research" as opposed to basic research. Also conducted in order to acquire new knowledge, applied research has practical, well defined goals for solving some specific problem and focus on the delivery of a result-oriented implementation of a new product or service.

2. Questions about the digital paradigm

In our contemporary society it is not possible to talk about technology without resorting to its central paradigm, the digital one. From Negroponte (1995) to Castells (1999, 2004) and Lévy (1993, 1999), many authors help us think about the impact that new electronic reality causes on how we communicate. Johnson (2001) appeals to the importance of interfaces for trying to understand our relationship with the ITCs. According to him the art of representing binary numbers. When dealing with the representation of ones and zeroes on computer screens, Johnson (2001, p. 33) affirms interfaces are "a way to map this new and strange territory, a mean to orient ourselves in a disconcerting environment". Although using *bits* as its most elemental language, in the end just electric pulses meaning 'on' (0) or 'off' (1), computers deal with signs and symbols. So, according to the author, the interface acts as a translator which is capable of mediating parts in a semantic relation, characterized by meaning and expression, and not by physical strength.

In this sense, we need to understand digital revolution beyond the ones and zeroes of the binary code, since according to Johnson (2001, p. 17) the magic arises from the computer's self representation to human beings on a language that can be understood. In the end, we think by means of words, concepts, images, sounds and associations.

And its relegated to technicians the task of translating information, something that according to Johnson (2001, p. 20) will demand a new visual language, complex and significative, from a genuine art he calls "interface design". However, he draws attention to the fact that "the most profound change foreshadowed by the digital revolution will not involve props or new programming tricks", but "will be linked to our generic expectations regarding the interface itself". As Johnson (2001, p. 164) warns us, "the culture of the interface will not get far, of course, if its most enigmatic spaces cannot be ultimately conquered, understood".

3. Clash of languages

It can look quite obvious to some, but it is important to note that many people are unaware of the fact that the newspaper chronicle, the resume sent via e-mail to a job agency, the picture post on a social network, the bank statement got on an ATM, the

video game avatar, they are all digital, binary, a sequence of ones and zeros that depends on mathematical processing, on algorithms, for it to become useful information for computers.

In computer science, algorithms can be understood, as shown by Salvetti and Barbosa (1998), as a finite sequence of instructions or basic operation that must be executed in order to solve a computational problem. Still according to the authors, those instructions are well defined, unambiguous, and can be executed in some finite time. For someone to achieve something useful by means of those instructions, it is necessary to dominate an idiom, most likely English or French. In computer science, what we call "language" can be situated in many levels or layers. There is the binary code, but there is also an intermediary layer that sits between it and human language. Usually composed of English keywords and a predefined set of rules, in the hands of a skilled programmer it can be used to build a sequence of commands that can be comprehended by machines.

Probably many people have heard of names like Java[5], JavaScript[6], C/C++[7], Pascal[8], COBOL[9] at least once. Those terms refer to programming languages, and they are extremely important in our everyday relationship with digital technology. Because in the end, almost nobody wants or needs to write commands to the computer in binary code, but using more expressive programming languages.

In Brazilian computer science lingo, the expression "to brush bits" is commonly used to designate the act of going very deep into some programming language. This is usually done when the programmer is after a very hard to achieve performance improvement, or they are after some hard to spot bug. That expression is important because it can helps us figure what is called "abstraction level". The deeper one can comprehend a given

[5] Java is a programming language (and development platform) used to develop applications for the Web, mobile devices, Digital TV, Blu-Ray players etc.

[6] JavaScript is a scripting language used mainly to provide dinamic behavior to Web pages (static by nature).

[7] C and C++ are both programming languages standardized by ISO and are among the most popular for systems programming (sofisticated games, desktop applications, operating systems etc.

[8] Pascal is a programming language originally created for teaching purposes but which eventually gained traction in the development industry during the 1990s.

[9] COBOL is one of the olders programming languages, appearing for the first time in 1959. It is most adopted in the business of trading, financial, and administrative systems.

programming language or platform, the lower the abstraction level. It can sound strange at first, but higher level languages are considered those broader and closer to natural language, thus far easier to understand than binary code.

Even though that description about programming languages is quite generalist, it can guide us to a world full of concepts without material base, sensible and perceptible by our senses, something that depends on an abstract mental process. Machado (1995, p. 146), talking about video art after the advent of digital technology, affirms that the informatics culture shakes the canons that until now allowed us to distinguish between concrete and abstract, or between natural and formal.

Negroponte (1995, p. 17), on the other hand, says that "the best way to evaluate the merits and consequences of digital life is to reflect on the difference between bits and atoms". What Negroponte wants to draw attention to is the fact that encoding something using bits creates a counterpoint to the very materiality of things. Thus, a newspaper delivered on the doorstep is of atom nature – it is there, embodied in its form and substance, ink on paper, while its digital version on the Internet is all about bits, a numeric information represented in the computer screen as text, image and, perhaps, audio and video. (NEGROPONTE, 1995, p. 18).

4. SACI and media production management

SACI, as described in Botelho-Francisco (2011), Botelho and Cicillini (2007), and Bela and Botelho (2006), is a digital tool for managing information, content, and communication vehicles. The system is used to record press contacts, requests for publication, and production of news for radio, Internet, press releases, magazines, social networks, among other platforms. Created in 2004 as part of a post-graduate course in Computer Science at UFSCar, its innovative character convinced the institutional administration to invest resources for the optimization of a functional prototype. After receiving positive evaluations, it started being used in production by the team of Coordenadoria de Comunicação Social (CCS) at UFSCar and by Rádio UFSCar since 2007. Over time, the software has become an indispensable tool for team work of the professionals active in the administrative units, comprising editors, journalists, interns from areas such as Communication and Information Science etc.

By the moment this paper is being written, 13 media products are handled by the system, five of them Internet-oriented, three using mailings – among them sending press releases to the local, regional and national press – two printed vehicles and three radio programs. This successful experience gave visibility to the project, and as consequence several institutions have already expressed interest in using it (some already did it).

SACI enables not only the improvement of the work done inside an institution, but also stimulates a closer relation with a varied audience – both for dissemination and for content production – and the consolidation of activity registry processes. To achieve this, it provides users with three main interfaces or facades: internal, external and of consumption.

The internal area is a facade composed of several pages, all geared to the production of media content. Access to those pages is restricted to the production staff, which in turn has several mechanisms for internal communication and preparation of information material. The media content produced from this inner area can be of various types, ranging from photos and e-mails to press-releases, clippings and posts on social networks. Besides that, new types of products can be customized according to the needs of each unit, for example a proprietary content management system (CMS) or a brand new social network.

In order to guarantee that higher quality content gets produced, teamwork at the internal area is organized around tasks. Each task has its own personalized workflow and permission table. That way, users can work only on tasks assigned to them or part of the same unit, and given the same set of permissions. To ease this process, it was put in place some interesting mechanics such as automatic task assignment, load balancing and so on.

Besides media production, several other tasks normally performed by communication professionals are supported by SACI. Among them can be highlighted answering press calls, publication requests, appointment book, mailing management, and many others. As for the management of projects and people, there is a variety of reporting functions, and automatic portfolio containing all production of a user since its registration in the system.

To facilitate the execution of those tasks, SACI provides several mechanisms for internal communication, the main one being the chat. Always visible for all logged in users, its content is public, with optionally directed messages (broadcasting is the default) and synchronous transmission (immediate). In those cases where users need more privacy or when instant feedback is not required, it is possible to send private, directed, asynchronous messages (off-line). To prevent external users from inadvertently interfering with internal tasks, all those features are restricted unless valid credentials – user name and password - are given. Self-registry is not allowed, so new users can be created only by existing users.

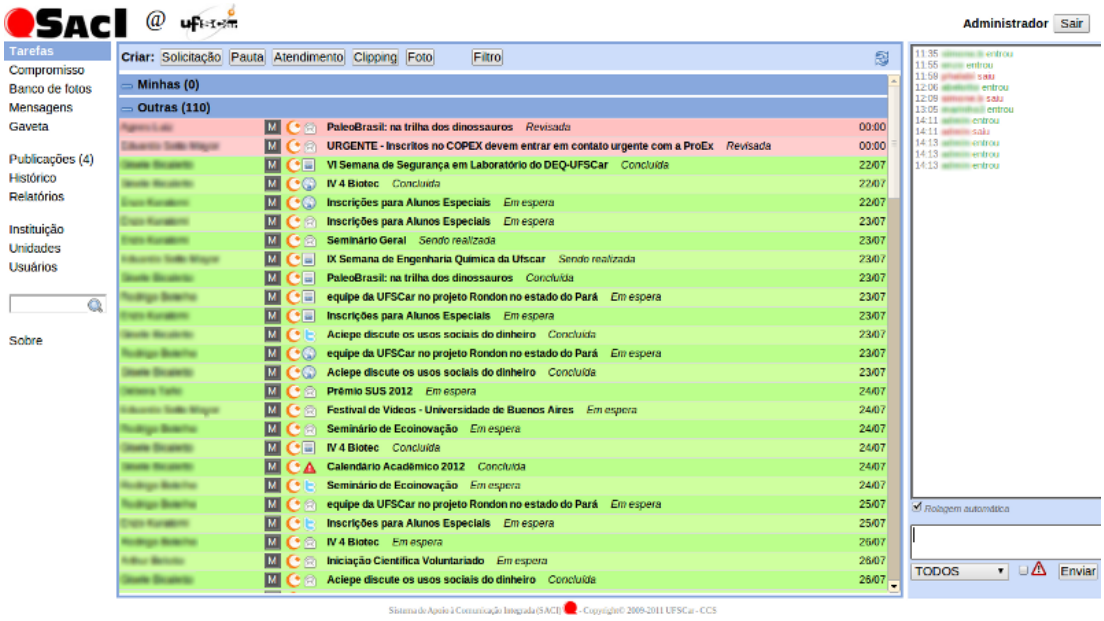

Figure 1 - Tasks listed in the internal area, at the center of the screen

The second most important interface to SACI is the external area. Just like the internal area, it also consists of several pages, but all geared to the external community. Access to them is free, ie, to interact with them no registration is required, and it can be done from the pages of the institution or its units. On CCS' website[10], for example, there are several points with content provided by SACI: last press releases, stock photos, mailing, calls to the press, clippings, publication requests etc. It is very important to stress that this integration between SACI and the units' institutional pages is transparent: visitors

[10] www.comunicacao.ufscar.br

usually do not know they are accessing a site whose content is dynamically provided by another system.

In addition to viewing content in the form of news and photos, a visitor can interact with those sites (and consequently with SACI) more actively, usually requesting something from the staff. In most cases, these actions generate tasks that are then sent to the internal area of the system. These possibilities promote an unprecedented integration between the community (external) and the production staff (internal), this providing a more collaborative and transparent relationship between the involved parts.

The integration with those websites is done through services, which are integrated by means of parameter passing and credentials checking. This greatly improves communication and helps direct content to the right administrative unit. A series of services are provided by default, grouped by:

- **institution**: services that are not associated with a specific unit, but the Institution where SACI is installed. Fit into this category the clippings listing, stock photos etc. Those service are usually integrated with the institutions' website[11], but nothing prevents them from being included on the site of a specific unit[12].
- **unit**: services related to a specific unit, and consequently with the unit scope[13]. In this category are publication request, press calls, press releases listing etc.

Besides the external interaction, SACI also automates some steps by sending e-mails. For example: when some clipping is created from a press release sent from SACI and requested by some external user, the requester is then notified via e-mail, so it is unnecessary for him to check the unit's website everyday searching for news.

[11] Example: www.ufscar.br

[12] Example: www.ccs.ufscar.br

[13] Example: www.radio.ufscar.br

Figure 2 - The external area, in this picture integrated to CCS's homepage. Emphasis on the form for requests for publication

Finally, the consumer area is not exactly a facade, but a set of pages and services of external people, that receive content from the internal area. Access to these pages and services depends on the source, as they can be free (as in the case of a news portal) or restricted (as in the case of a social network or webmail). The media content produced from this area is quite diverse, ranging from e-mails to press-releases, posts on social networks, news on content management systems etc. As in the external area, its content is formed from tasks worked in the internal area by the production staff.

Figure 3 - Example of consumer area, with content transparently provided by SACI. In this case, a Twitter account is automatically updated by the System

Besides this practical description, as pointed out in Botelho-Francisco *et al* (2012), we must emphasize that SACI is also being articulated in the context of other concepts, like RedeIFES, thought initially in 2003 by a group of teachers, technicians and students from Federal University of Paraná (Universidade Federal do Paraná - UFPR) as a network for searching and exchanging radio and TV programs made by Federal Institutions for Higher Education (Instituições Federais de Ensino Superior - IFES). However, over the years the proposal moved forward, and it was incorporated under the National Association of Directors of Federal Institutions (Associação Nacional dos Dirigentes das Instituições Federais de Ensino Superior – Andifes), received grants from the Ministry of Education (Ministério da Educação - MEC) and from the National Networking for Teaching and Research (Rede Nacional de Ensino e Pesquisa - RNP) and now it is no longer considered a *software*, but a concept of collaborative work between teams of communicators inside the IFES. It is from this concept that are being structured proposals for a customized version of SACI and a news agency focused on science and technology. The assumptions that guide the project will also involve the concept of an agency as a decentralized, collaborative, and autonomous network. Thus, the agency would not be just a site that gives visibility, but the source that diffuses information to subscribers (journalists and media companies).

5. A technical report about software development

For SACI to perform all those features, the content produced must be created, stored, processed, recovered and broadcasted through the use of a software system. A system

like that should be developed using a set of techniques that allow this to happen according to rules and standards, and that from its project until its execution it uses some techniques from Software Engineering, like the ones described in Rumbaugh *et al* (1994) for object-based modeling and design, or like in Korth (1989), for database management systems.

In software engineering, the application "domain" is the set of requirement and terminology common to other programs created to solve similar problems. It is in this context that the problems and proposals that the software will handle should be identified and detailed. This is done initially through the description of functional requirements, which are descriptions of the functions of the system, along with their inputs, behavior and outputs. In the example of SACI, we considered the entire relationship maintained with CCS to observe and describe its operation.

From the problem identification and requirements description to the final product delivery, there is a well defined order that follow steps, methodologies, umbrella activities (disciplines) and proper tools. Furthermore, it is essential that this process be planned and documented in accordance with established standards like the *Unified Model Language* (UML), as presented by Booch, Jacobson and Rumbaugh (2001), that guides the software modeling process in a conceptual process independent of the programming language.

In more specific terms, the methodology that has been used in the improvement of SACI is known as "spiral". It is based on constant product refinement and several rounds (iterations) where functional versions of the system are released, many times a year. Each iteration comprises the steps of requirements planning, risk assessment, coding, testing and planning the next iteration. In this proposal, the requirements collection and analysis was made with more devotion at the beginning, but also happened after the project phase. With that, both the architecture as well as the project are defined and documented, and from there start the coding and prototyping.

The development process, in turn, is driven in a controlled manner with the aid of support disciplines, also known as umbrella activities. Among those activities and practices there are task management (requirements, defects etc), revision control, tests (system, integration, unit), automated build, continuous integration, and others.

The result of all this work involving methodologies and disciplines is the source-code, a set of instructions written in one or more programming and markup languages. In our example, we use basically the languages HTML[14], JavaScript, CSS[15], Java and SQL[16].

[14] HyperText Markup Language (HTML) is the most popular language for the representation of Web pages.

[15] Cascading Style Sheets (CSS) is a stylesheet language used along with HTML for the creation of styled pages.

Once the source code is ready, it is necessary that it becames effectively executable by an operating system such as Linux, Windows or MacOS. It is at this stage that the source code written by the programmers is compiled and turned into binary code or interpreted by other programs.

Tipically we do not have access to the source code of a program and, most of the time, we are not interested in that when we execute it. However, it is useful to understand that a source code can be open (accessible to those interested) or closed (limited to the owners). The Microsoft Windows operating system, for example, is a proprietary software and its source code is a top secret. On the other hand, the Linux operating system is one of the most famous examples of open source system, as access to it is open. Open source systems that guarantee a certain amount of freedom to users, such as the ability to modify and redistribute it without having to ask the original authors for permission, are classified as free software. SACI is a free software, because its source code is fully available and it is developed and distributed according to the terms of an specific license[17].

6. Challenges of applied research

Communication is noticeably a multidisciplinary area, and over the years it built theoretical relationships with disciplines such as Social Sciences, Philosophy, Psychology, among others, which yielded important legacies to communicative thought, for example, any discussion involving the concepts of Cultural Industry and Mass Media. In addressing this issue in late 90s, Lopes (1999) approaches the complexity and mutation of objects in the context of the Social Sciences as something of its own, since they are dynamic and mutable due to their nature, and proposes a consequent variety of methodologies. Lopes (1999) states that the methodological criteria of the available options will involve the complexity of the communication phenomenon and the difficulty of studying it from the perspective of a single science or discipline, as well as its multidimensionality and consequent configuration as an object of interdisciplinary study. Thus, Communication would not have one preferred method, but a multitude of methods available, something that far from granting it a lesser status, must be understood as part of its own dynamics.

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[16] Structured Query Language (SQL) is the de facto standard for the realization of data manipulation and description on relational databases.

[17] SACI is licensed under the GNU General Public License version 3.0 and is registered under the Instituto Nacional de Propriedade Industrial (INPI).

In that multidisciplinary proposal, Communication also ventures itself into even more diverse areas, such as Hard Sciences. In this bowl, we have Computer Science and its relationship to the design of ITCs. Beyond the theoretical challenges of this relationship between Communication and Computer Science, comes a new area, and that is the development of ICT proposals. Accordingly, research flows from a basic research context to an applied research context, something not only challenging but also audacious.

How can Communication interact with distinct areas such as Computer Science and yet manage to develop applied research and generate expressive results, embodied in the very technological tools we use? It is certainly a very hard question to answer, and we do not intend to answer it in this space. However, we understand this is an interdisciplinary work, and specifically in what relates to the development and improvement of SACI, this challenge has been demonstrated in practice from the relationship between the professionals of such distinct areas. It can be seen also in the constant struggle to turn into software requirements all the concepts, paradigms e discussions promoted in the context of the knowledge that has been theorized and produced about ITCs by Communication. Everything under the light of proposals like media convergence, collaboration and interactivity.

In addition, another very important challenge has been to maintain a team of professionals that not only is able to produce theoretical results, but also deliverable artifacts like software and its documentation, constantly improved. In this regard, it has been constant the search for financial resources to keep active an interdisciplinary team, what is specially hard for Computer Science professionals because of their elevated cost. Brazilian funding agencies do not pay special attention to this kind of interdisciplinary effort, and recent edicts usually focus on areas such as Engineering or Software Development for Health, nanotechnology, and others not related to Communication.

7. Future work and final remarks

The account given in this paper on SACI was proposed in this space as a reflection exercise on the theoretical and practical issues involved in its development process. We are aware this is not a thread that simply runs out with the arguments presented here,

and we intend to pursue it in order to produce knowledge from the very practice of software development and not only from its study from an analytical perspective. This corroborates our point of view that it is extremely important to work on a multidisciplinary project for the proposition, development and improvement of ITCs so that the technical result involves cultural, cognitive and social issues.

Apart from that perspective, there is a large set of requirements already mapped to the next versions of SACI, providing it with features such as integration with new social networks, internationalization (i18n), scheduled events like sending media content (without human intervention), and the management of graphical jobs such as folders, banners etc. Besides that, SACI is part of RedeIFEs, what puts the group in contact with other development teams from UFPR and Coordenação dos Programas de Pós-graduação em Engenharia (COPPE) from Universidade Federal do Rio de Janeiro (UFRJ) in proposing integrated solutions with other systems and proposals, such as a Science and Technology News Agency and a *webcasting* platform, as presented by Rocha and Estrada (2011), which features advanced media services like hosting and distribution for Web and TV. The general perspective is of integrated systems so that this environment for media production becomes increasingly collaborative and, mostly like free software, allow other actors to offer their expertise for a common improvement.

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