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Connecting Social Science and Information Technology Through an Interface-Centric Framework of Analysis

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ABSTRACT

The gathering pace of IT innovation has, or ought to have had notable methodological repercussions for the social-science community (and beyond). Where yesterday the researcher could unhurriedly unlock the social-scientific significance of a chosen medium, secure in the knowledge that his or her work would have bearing for many years, by now there is every reason to confront a fear that the prodded IT implementation may in fact be gone or at least heavily altered by the time such comprehensive research is concluded. This paper will propose a complementing systematic “interface-centric” research model capable of interconnecting a non-finite variety of IT implementations and social science studies in a coherent way. The paper also outlines how users “downstream”, whether political actors or technology operators can use the proposed framework to more easily approach and weight academic input when evaluating complex IT effects.

1. A METHODOLOGICAL CUL-DE-SAC

Exploring ways, a decade ago, to understand and systematise the evolving IT situation as a social scientist, the better to apply my field of expertise (which happened to be democratic theory) on this dynamic field, I noticed a real and urgent problem. It seemed to me that the gathering pace of IT innovation and evolution had rendered existing analytical strategies obsolete. The predominant social-scientific approach was to examine individual IT *implementations* with the aim to make “holistic” sense of its possible societal impact. Thus we find learned treatises about the French *minitel* system, about Bulletin Board Systems, about the fax, the telex, the video etc., where the various authors aim to examine how each technology affects the human condition, as based on some preferred theoretical perspective.

There was a notable advantage intrinsic to this “implementation-centric” approach. To place a specified technology at the very analytical heart, conceptually linked the many varied actors who had an interest in it. Academics, manufacturers, politicians and pundits (to identify but a few such actors) all shared a somewhat analogous idea what *minitel* was all about, and so could pick up on, and process, other actors’ input. There was, to use an economic term, a great deal of information liquidity within each implementation sub-field.

The problem was and is that such a methodology requires a very long technological “half-life” to be viable. But where yesterday a researcher could unhurriedly unlock the social-scientific significance of a chosen medium, secure in the knowledge that

nificance of a chosen medium, secure in the knowledge that his or her work would have bearing for many years, by now there is every reason to confront a fear that the prodded IT implementation may in fact be gone or at least heavily altered by the time such comprehensive research is concluded. To put it harshly: how relevant are those meticulously compiled studies on the social impact of the *minitel* or the telex machine today? Is an analysis of communication technology X reasonable when X.1 and X.2 lurk just around the corner?

It then occurred to me that an “implementation-centric” methodology really had proved inadequate even in its heyday. Yes, it was possible to study the impact of, say, the *minitel* from a variety of research angles. Yes, it was thus theoretically possible to amass complementing data from a variety of sources to triangulate the wider societal significance of *minitel*. But information liquidity, crucially, was limited to communication-technological sub-fields based on individual technologies. Great artificial barriers divided the pools of liquidity, even though it is easy to see that findings from any given field might have, indeed *ought* to have, an overarching impact on the others. After all the common theme is *communication* albeit in a variety of forms. It should of course be stated that many scholars use abstract theory to bridge these divides (perhaps to study many different implementations using a prepared set of analytical tools), but this simultaneously reduces liquidity: very few of his or her academic peers from other disciplines, let alone non-scholars, will have the time or the will to traverse such inaccessible bridges.

With a radically reduced technological half-life, a consequence of the building momentum of the Internet as a ubiquitously employed infrastructure, this crucial advantage of an implementation-centric approach are at any rate growing chimerical. When an author refers to the impact of “IT” or “the Internet”, without any clarifying preamble, it comes across as a wistful throwback to a bygone era. Is the author really thinking that “IT” provides a conceptual common ground on a par with “minitel” two decades ago?

2. DESIGNING A NEW METHODOLOGY

Realising that the outlined methodology was dented beyond repair, I set myself the task to think through a methodology to supplant it. I began by establishing a set of guiding design parameters.

I wanted the replacement methodology to

- reside on an abstraction level which precluded any reliance on a long technological half-life
- be relevant across individual technological implementations
- provide inter-disciplinary information liquidity, by means of an information “storage technique” that was readily understandable and usable across disciplines and actor types.
- be constructed in a way that, ideally, allowed it to be grafted onto existing studies with a minimum of effort.

To keep individual implementations as methodological “gravity wells” of choice was impossible because their characteristics continually evolved. But what if the focus was the actual characteristics? Properly anatomised such characteristics would prove both durable over time and concrete enough to serve as common, tightly-knit, conceptualisations. The eventual test, for me, would be if

- it would be possible to build social-scientific constructs around or interconnected with these conceptualisations (I used my own democratic-theoretical foundation as test bed), and;
- it would be feasible to devise *policy* around them (this would suggest that non-academic actors could adopt and use the framework).

“Characteristics” is a vague term, and may be understood in many ways. My aim was to extract *communication dimensions* that were “a-empirical” in character (i.e. not exclusively bound to specific technologies), yet possible to make operational in a given empirical study. I decided to focus on the *interface characteristics* that face senders and recipients (this dual outlook is, I think, crucial). Regardless of the communicative situation, certain limitations and opportunities present themselves to a given sender and recipient. It may, or may not, for instance, be possible for the sender to stay anonymous when conveying a message, just as it may (or may not) be possible for the recipient to stay anonymous when picking it up. I basically aimed to locate a complete list of interface characteristics belonging to the same *class* as sender and recipient anonymity. Overlap or nesting among these dimensions were deemed unacceptable – the dimensions need to be “atomic” for me to argue in earnest that they do indeed belong to the same class as sender and recipient anonymity.

Every form of artificially mediated communication (i.e. every time an information technology implementation is employed) makes such dimensions readily observable to the keen eye – after all, both senders and recipients deal with interfaces when interacting with communication technology. This observation made appealing a strategy where various IT:s (actual implementations) were compared in order to extract final dimension candidates. To this end, I employed a simple snowballing methodology, where new IT:s were added to the comparison process until marginal gains became negligible. The net result of this undertaking was a list containing some thirty dimensions which seemed (and still seem) to conform to the stated criteria. *The pivotal realisation is that every studied communication technology can be reinterpreted as a combination of dimension states.*

Space constraints make it impossible to present each locate dimension in detail here, though a condensed list will be appended to the end of this paper, and I refer the reader to Sundström, 2001 for an expanded exposition. In this text I will use a

token subset to emphasise certain methodological points. We have mentioned anonymity, in its two distinct (but nevertheless routinely overlooked) varieties: *sender* anonymity and *recipient* anonymity. *Pervasiveness* is the level to which the recipient is able to *avoid* a message (a message conveyed by a tub-thumper in the street is thus more pervasive than the message in a newspaper that you yourself have to pick up in the newsstand). *Information richness* is the transferable amount of data in a given time. Based on experience, I here ask the reader not to direct criticism at the adopted *labels*: it is the underlying *concepts* that are under scrutiny. I might have used mnemonic abortions like dimensions X, Y & Z to avoid controversy, but abstraction for abstraction’s sake holds little appeal for me.

3. AN INTERFACE-CENTRIC MODEL AT WORK

At this stage, the various dimensions are pristine, in that they hold no significance beyond their functional (relative) existence in individual technological implementations. Since they spring from a pure technology review, they carry no integral normative baggage. They just are, or are not, or are to a specific degree, one might put it.

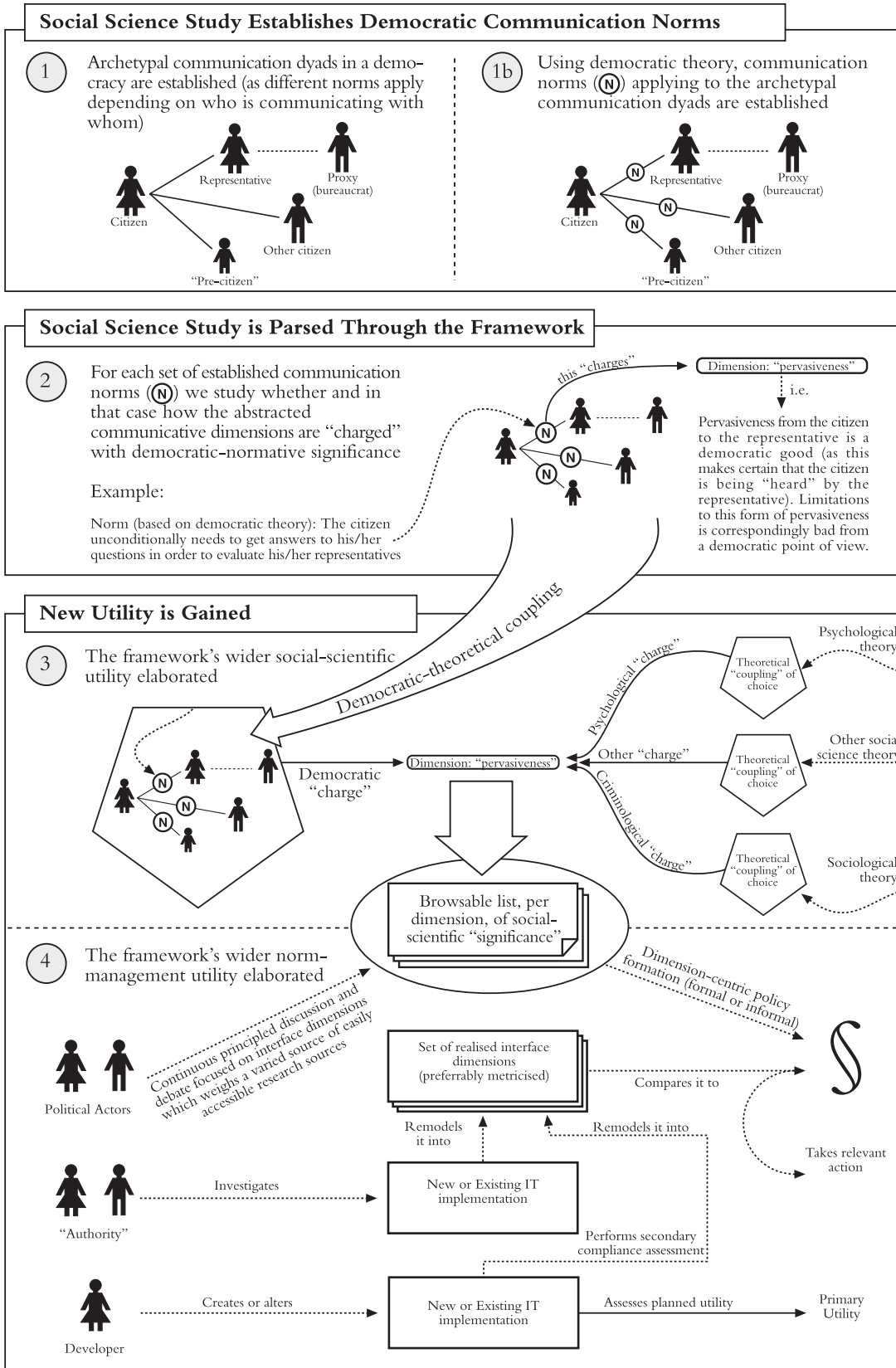
The true worth of the model becomes apparent when we realise that such a statement is patently untrue. We actually harbour very strong convictions indeed vis-à-vis certain of these dimensions. We have the intuitive – or well-informed as the case may be – sense that they affect how society works, whether for good or bad. And “we” include members from all the actor groups we have discussed *en route* – including the academic community.

Each dimension is thus more than ready to be “charged” with normative significance. I happen to base my own input, per relevant dimension (e.g. sender anonymity) on my reading of democratic theory. A psychologist will use the theoretical tools of his or her trade to provide further insights into the impact of sender anonymity. Etc. Downstream, practitioners, pundits and politicians will suddenly have easy access to a structured library of views drawing on theoretical traditions they will not be required to master. These informed views can in turn be weighted to prepare for real-world decisions on a variety of levels.

Figure 1 (below) illustrates the process in its (archetypal) entirety. In it, a sub-component of my own democratic-theoretical discussion is used to demonstrate how abstract theory can be “parsed” through the framework in order to charge a dimension (in this case *pervasiveness*) with normative significance. It seems prudent to reiterate the point that as such principled normative input is now uncoupled from communication technology *per se*, it should prove a robust feature in a rapidly altering communication landscape.

A final preparation before turning to the figure. Democratic theory is a diverse body of literature (and thus a good representative, it seems to me, of almost any given social science sub-discipline). Of importance here is that democratic scholars hardly ever address communication norms *directly*. It becomes a matter of sifting through (often convoluted) normative statements using the framework as a pan to extract the “dimension nuggets”. When I note that an author claims that the better argument should win the day regardless of the originator’s status, that author tells me that sender anonymity is a democratic good in *his* (not mine I hasten to add) conceptualisation – after all, the argument will then be uncoupled from the individual.

Figure 1 An Interface-centric Framework of Analysis at Work



NB. This is a bona fide study, but it will not (for obvious reasons) be presented *in extenso* in this paper, but is merely used as a relevant example

4. NEW UTILITY FOR THE ACADEMIC COMMUNITY

In the figure, I have compartmentalised two distinct, if interrelated, groups of beneficiaries. I will now proceed to briefly extend and clarify certain points relating to each – (3) and (4) in the figure.

Under (3) we find the scientific community hard at work, as researchers from a variety of fields take the opportunity to slot in findings in the relevant “dimensional holding boxes”. Clearly this effort will involve considerable simplification. The “slotting process” brutally shears off complexity – but that, of course, is also an alluring point for everyone from beyond one’s pinpointed field of expertise: findings may be simplified, but they are also made approachable. One thing I found when delving through studies about information technologies, new and old, were how hopelessly incompatible they appeared to be. To try to systematise findings from across studies proved migraine-inducing, as they all adopted their own idiosyncratic approaches, or, more commonly, *stubs* of idiosyncratic approaches. Widespread use of the presented interface-centric framework, if only to present a minimal subset of relevant findings, would lend the framework certain Rosetta-like qualities. We would quite simply gain a new way to sort and locate our peers’ research efforts that somehow deals with, or at least intersects with, “communication” in a wider sense.

Now, it is of course possible to go all-out, and use the framework’s dimensions to structure a research effort from the ground up. I confess to be under no illusion that wholesale adoption of such pervading strategies is in any way imminent (feel free to prove me wrong). Fortunately, the framework can be piggy-backed onto existing studies and still generate most of its suggested benefits. It is in that case a matter of asking oneself what one’s completed study has to say about each dimension (if anything). Any “dimensional entry” will strengthen the framework, and make it gain traction.

5. NEW UTILITY FOR PRACTITIONERS

As soon as a social scientist adds to the common pool of knowledge about (for example) information *pervasiveness* and its consequences, we get a boost of utility downstream – (4) in the figure. Anyone concerned with strategic IT planning or policy making would for instance immediately be able to draw on a substantial and varied, yet uniquely accessible source of information about intrinsic interface characteristics, and their various perceived consequences, information that he or she is highly unlikely to come across in a compiled form otherwise.

Political actors are really *norm-managers*, and face a specific problem when technological change becomes too rapid or too complex. Instead of providing guiding norms in a timely manner, they are reduced to reactive bursts of activity to fend off some surfacing ill effect or other. The framework just might make it feasible to form pro-active policy around specific interface characteristics as such. It would for instance be quite possible to regulate *sender anonymity* and to disallow it, or allow it, based on the comprehensive guidance provided by the framework.

Consider the evolution of sender anonymity over “the horn” as they used to say. In its infancy, telephony offered little in the

way of anonymity as local switch operators were likely to be able to identify callers. Things looked up for breathers and others questing for anonymity when the telephonic system grew in size, and even more so when human operators were replaced by automatic mechanical switches. *Electronic* switches then introduced *Caller ID* as an option for people to (somewhat) *reduce* sender anonymity, while certain dial-based services were offered to *circumvent* Caller ID. What has in fact driven this evolution, except technological and economic feasibility? At least in my native Sweden, no sign of a comprehensive review of (sender) anonymity and when and why such an option should be on offer has ever been carried out on the political level (or indeed elsewhere), and so all other actors are left without specific and overarching guidance in the matter. The very approach remains unexplored, even though there is no lack of (contending) ideas concerned with anonymity in the public debate. The framework, properly used, would certainly sow the seed of such a complementing policy focus.

A clarifier is in order. A “political actor” is sometimes understood as a person involved in the purely democratic-political sphere, but in this paper we use the term in its wider (and indeed truer) sense. Actors making policy (and thus instituting norms), on any level, are political actors. Much simplified, Microsoft’s Chief Software Architect (no doubt in conjunction with a range of other officials) is a political actor, establishing certain norms to be generally adhered to. Other company entities act as authorities, making sure that these principles are upheld on the implementation level. The key realisation is that the framework carries with it similar benefits for “political norm-managers” on every level. Each subordinated level will of course have to take into account norms established on the more senior level(s) (e.g. the Chief Software Architect will have to abide by sub-national, national and international norms as expressed in laws, regulations and international treaties).

It finally seems intuitive to suggest that, since every existing or planned communication technology can be dissected into its component dimension states, advanced studies could examine and tentatively project “dimensional trends” to help inform business decisions. For the most part I happily leave this particular aspect of the framework for someone else to explore. It does however raise the issue of dimension *metrics*.

5. OF DIMENSIONS AND THE WANT OF METRICS

The extracted interface dimensions are just that: dimensions, ranging from nil to comprehensive. In a few cases we have external and more or less standardised measurement metrics to fall back on (e.g. bps for *information richness*). In most other cases we do not.

There is every reason to believe that coherent systematisation and measuring principles would be very usable indeed in a variety of analytical situations. Again consider *sender anonymity*. While we at this point may simplify matters by conceptualising this dimension as intrinsically binary in nature (either the sender *is* anonymous or *s/he is not*), real world anonymity is more likely to be a function of the *cost* an outsider would have to incur in order to unravel the (purported) anonymity. When this cost approaches infinity, the sender is for all intents and purposes truly anonymous. Such an enhanced conceptualisation, complete with its own dedicated metrics, would radically simplify comparative empirical discussion (e.g. whether or not this

or that technology makes the sender able to stay this or that number of “units” more anonymous than this or that other technology). Indeed, a complementing methodological door would open, as quantitative analysis would suddenly become feasible.

“Metricised” dimensions would also provide a far better foundation for policy debates and initiatives. A crude example: “society should never accept a *sender anonymity* level exceeding, say, 72 ‘units’ [however these may be defined], except in these specific circumstances where 95 is deemed acceptable”.

This brief discussion emphasises an important point that extends the framework’s basic premise and one that, properly implemented, would vastly extend its general applicability and utility. Scholarly “meta-analysis” of, and discourse about, any and every of the framework’s communicative dimensions, and how they might be metricised would be profoundly beneficial.

6. FINAL COMMENTS

The framework I have presented is really based on a blindingly simple idea. Yet, a decade after I first began thinking about these matters, I still have not encountered an equivalent proposition. This is not to say that the integral *dimensions* are in any way unique – indeed they turn up in many a study either directly or indirectly. For me, this is in part good news, as such authors would immediately be able to add their findings to the common storage structure provided by the structure.

It is the *organised understanding* of the dimensions’ *interrelationship* that seems to be overlooked or ignored. Tiny islands dot the map, yet no-one seems to realise that it is really an archipelago they are navigating.

I harbour no doubts that the framework can be mightily improved upon, and I welcome any and all input to that effect. But neither do I doubt the framework’s potential promise. The obvious, looming, perhaps insurmountable, obstacle hinges on (a lack of) initial adoption. Had fifty social science studies’ worth of normative input already been invested in it, the framework would probably have gained the required inertia to take off in earnest. With the results of just one meagre democratic study in its dimensional coffers, it still languishes in the neonatal clinic, and all bets are off. For now.

APPENDIX: THE DIMENSIONS IN BRIEF

Property	Short description
Access-time	The time it takes to establish a link between a sender and a (known) recipient.
Commoditisation	The extent to which any information-extrinsic matter must be part and parcel of the information exchange (e.g. the paper of a newspaper)
Connection validation	The extent to which the sender can ascertain that a link with the recipient has been established.
Cost of altering disseminated	The potential to alter already disseminated information, e.g. the poten-

information.	tial to alter on-line HTML-pages. Cf the lack of such a potential in a television context
Directionality (bi- or uni-directional)	A bi-directional information mode allows the initial recipient to switch to a sender capacity using the link established by the initial sender (e.g. a telephone conversation). A uni-directional information mode forces the initial recipient to (try to) establish a new link if s/he should wish to switch to a sender capacity (e.g. replying to a letter).
Encoding method	The method by which the information is encoded “en route”
Environmental interference	The extent to which environmental factors can affect the information link.
Hyperlink transparency	The recipient’s required effort to follow a “hyperlink” (i.e. a reference) to another information source.
Information density	The extent to which the sender intentionally includes material beyond the recipient’s expected capacity to absorb (e.g. newspapers, where a majority of the articles will never be digested by the individual reader).
Information richness	The amount of data transferable in a given time
Information sequentiality	Whether or not the flow of information is temporally bound (compare television and a letter, where the contents of the latter may be absorbed in a non-linear fashion)
Interactivity	The relative enabling of partially or wholly overlapping roles as sender and recipient.
Level of primary human agent involvement	The extent to which the IT is dependent on human involvement to maintain a link between the sender and the recipient (e.g. the postman).
Level of secondary human agent involvement	The extent to which the IT is dependent on human involvement to maintain the integrity of the information channel as such (e.g. maintenance personnel in telcos).
Parallel sending area	The potential for multiple senders to send information via a single cohesive area which recipients can then access.
Pervasiveness	The extent to which the recipient is able to avoid information “en route”
Real-time transfer	Whether or not the mode of information exchange requires the sender and the recipient to be active simultaneously in order to function
Recipient access-point individualisation	The extent to which the IT’s recipient access-point is private or public (e.g. telephone vs. wallpaper)
Recipient ano-	The extent to which a sender can stay

nymity	anonymous while receiving information
Recipient enabling cost	The recipient's initial cost to gain access to the information channel. E.g. the cost of a radio receiver.
Recipient transfer cost	The expenditure for the actual reception of information. E.g., cost of the electricity needed to keep a computer on-line.
Recipient validation of information exclusivity	The recipient's ability to ascertain that the received information has not been picked up and/or unravelled by an outside party.
Recipient validation of information integrity	The recipient's ability to ascertain that the received information matches the information originally disseminated by the sender.
Recipient verification of sender authenticity	The extent to which the recipient can determine that the sender is who s/he claims to be
Search and retrieve ability	The level to which information is searchable when the recipient wish to retrieve it (e.g. database systems)
Sender access-point individualisation	The extent to which the IT's sender access-point is private or public (e.g. telephone vs. letter-box)
Sender anonymity	The extent to which the sender can stay anonymous while using the information channel to transfer information. This is a dimension that hinges on the cost a second party must suffer to reveal the sender's identity. If that cost approaches infinity then the sender is for all intents and purposes anonymous.
Sender awareness	The extent to which the sender is aware that s/he has assumed a sending role.
Sender enabling cost:	The sender's initial cost to gain access to the information channel. E.g., expenses for technical equipment and licensing fees required to be allowed to operate a radio channel.
Sender transfer cost	The expenditure for the actual sending of information. E.g., the running cost for the use of the telephonic network.
Sender validation of information exclusivity	The sender's ability to ascertain that the disseminated information has not been picked up and/or unravelled by an outside party.
Sender verification of link integrity	The sender's ability to ascertain that the disseminated information has reached its intended recipient.
Subscription	The extent to which the recipient can automate a recurring reception of information

LITERATURE

This paper is unusually devoid of bibliographical references, but it is my fervent hope that the reader will not be offended by this, given that it is a piece relying on deductive logics more than anything else. This said, my thesis, in which I first introduced this line of thinking, lists a variety of inspirational sources, though most of them inform the sizable democratic-theoretical part of that book. I thus humbly refer the reader to the thesis for further information.

Sundström, Mikael. 2001. *Connecting Social Science and Information Technology. Democratic Privacy in the Information Age*. Lund: Department of Political Science. Also available at: http://www.svet.lu.se/Fulltext/Mikael_sundstrom.pdf