

Documentarisation processes in Documents for Action (DofA): the status of annotations and associated cooperation technologies

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Abstract: In this paper, we focus on situations where documents serve to coordinate the work of a distributed collective engaged on common goal-directed activities. After defining the concept of semiotic products as resulting from symbolic communicational transactions, we present some coordination strategies which can be used to compensate for the spatio-socio-temporal distribution typical of these transactions. Among these strategies, it is proposed to study in detail the documentarisation strategy, which makes the material substrate mediating the transactions relatively durable and endows it with attributes making its further use possible. In our study on documentarisation processes, several novel concepts are introduced: distinctions are made between transcription vs recording, the two-fold external vs internal articulation, and the implicit vs explicit semantic links between the various fragments of a document. These concepts are used to draw up an exact definition of Documents for Action (DofA) and their characteristics. Annotation is defined as an activity serving to articulate documentary fragments with DofA in order to effectively support cooperative activities. In this context, we analyse a number of cooperation technologies, focusing in particular on newsgroups, which are taken to be a form of annotative technology. Lastly, we stress the importance of codification in documentary investment processes and describe the conditions required for this part of the process to be properly carried out.

Key-words: Document, Document for Action (DofA), Documentarisation, Annotation, Cooperative Writing, Newsgroup

1 The advent of digital documents: an economic-managerial, CSCW and Knowledge Engineering approach

The development of the Web either in the internet or intranet context has resulted in a multiplicity of document-related collective practices, including those of a strictly professional kind (such as projects mediated by plans and contracts and health-care networks based on patients' records) and others working on less highly structured lines (such as activist groups and communities of interest sharing common goals). A whole set of new document-related practices are therefore emerging, ranging from making documents available to a team by placing them in small data management systems forming "small digital libraries" to the use of annotations while collectively writing and disseminating documents, using tools such as Wiki and Blog.

To account for the diversity of these practices and the collective and evolving nature of the documents or sets of documents undergoing the writing process, we previously defined the concept of Documents for Action (DofA, Zacklad 2003c). These documents have some characteristics (their prolonged state of incompleteness, their durability, their fragmentation, the diverse commitments of their authors, the evolving nature of their content, etc.), which challenge the latest "document theories" in several ways, especially as far as the management of the life-cycle of these documents is concerned: they often start to be published before they have been completed, and they can be constantly updated by adding annotations after the first version has been drawn up.

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In this paper, we will focus in particular on situations where documents are used to mediate the coordination of a widely distributed group committed to working towards a common goal. In contexts of this kind, the document in question can be viewed as a set of fragments contributed by various authors, the final content of which remains largely indeterminate, while its fast dissemination makes it a useful tool for conveying information, assisting decision-making and probing situations.

After defining the concept of semiotic products as resulting from a communicational transaction (Zacklad 2005a) between one or several creators and one or several beneficiaries or recipients, we address the issue of the wide spatio-socio-temporal pattern of distribution of these transactions, which makes it necessary to set up compensatory coordination strategies. Among the eight strategies defined here, we will focus in particular on the documentarisation strategy, which consists in perpetuating the material substrate on which these transactions are inscribed and providing it with the attributes required for its further use. Recent advances in the field of digitization have resulted in the widespread use of procedures of this kind based on the use of techno-informational equipment (which is both digital and physical) In this study on documentarisation processes, several concepts will be introduced: the distinction is made, for example, between *transcription vs. recording*, the *two-fold* external vs. internal *documentary interface*, and the *implicit and explicit semantic connections* between fragments of documents.

These concepts make it possible to draw up an exact definition of Documents for Action (DofA) and their characteristics. We will see in particular that these documents constitute a set which mediates *widely distributed emerging communicational transactions*. Annotating activities will be defined as activities serving to link together the fragments of DofAs with a view to achieving the common goals adopted. This approach will then be used to analyse some cooperation technologies, focusing in particular on newsgroups, which are taken to come under the heading of annotative methods. We conclude by underlining the importance of codification in the documentary investment processes, and define the conditions under which codification is possible.

2 A pragmatic communicational definition of documents: documents and files for action

2.1 *Hyperwriting and hyperfragmenting*

Here we take a broader approach than that usually adopted in studies on documentary topics, although several authors have already broken away from the traditional links with conventional written texts (cf. Brown & Duguid 1995, Briet 1951, Buckland 1997, Pédaque 2003). Here we continue on these pragmatic theoretical lines by investigating symbolic communicational transactions (Zacklad 2005a), using the framework we previously designed to account for cooperative activities, especially those mediated by a range of symbolic artefacts, taking a communicational, cognitive and socio-economic approach.

At the beginning, we focused mainly on documents of the kind produced and disseminated within professional organizations with clearly defined goals, especially in the context of the trend towards digitization, which creates flowing connections between intranet and internet. But we have come to realize that this approach also applies to the whole set of document types which have been analysed so far in the field of information science, some of which serve more “cultural” purposes in the broadest sense.

Before looking more closely at the information systems which convey documents that can go on being written at the same time as they are being read, and which correspond to the many uses made of internet at the beginning of the third millennium (fast diffusion of files via systems such as the e-mail, content management systems for web sites, newsgroups, online

annotation systems, weblogs, etc.) it seemed to be necessary to attempt to redefine both the concept of *documents* and the concepts relating to their content. It is worth noting that documents tend to no longer belong only to the category of written texts, since they often include images and sounds which can be picked up by a whole developing range of browsing and player systems.

With the development of internet practices, the collective production and use of digital documents has been increasing rapidly, especially as far as the production phase is concerned. From the point of view of the reception of the document, the main outcome of these collective writing practices, the fact that the production phase continues indefinitely is probably as important as the fact of including tangible objects in the definition of documents was at the time when it was first proposed (Briet 1951). To add yet another neologism to the ever-increasing collection, we would suggest that after the hyper-reading phase which occurs in the case of hypertexts, there is a hyper-writing phase, when digitized Documents for Action are drawn up out of many *evolving fragments of documents* by the very collective activities they were intended to mediate.

2.2 Cooperative semiotic production processes through documents and files for action

In an increasing number of cooperative professional activities, especially those of a mainly intellectual kind, the intermediate or final product of the cooperative process is a semiotic product which will serve in turn as a basis for further transactions on a larger spatio-temporal scale. Since structurally open teams intensively engaged in cooperative activities (Zacklad 2003) also tend to be widely distributed in spatio-temporal terms and their work environments are becoming increasingly digitized and networked, the use of documentarisation strategies prompted by the extended use of techno-informational equipment is becoming extremely popular. The techno-informational equipment used in this context consists, for example, of word processors which can be used to make annotations as well as being particularly well integrated into electronic mail systems.

However, communicational activities associated with structurally open cooperation involving the use of perennial substrates generate documents of a very different kind from the traditional works available in conventional libraries. These "documents for action" (DofA) are now becoming essential to cooperative collective activities and correspond to the increase in the collective use being made of ICT in the context of goal-directed collective action. In some cases, when DofA contain products resulting from separate but highly interdependent transaction situations, we are dealing with what we have called "Folders for Action".

There exist many different kinds of DofA, depending on the professional context. To quote just a few examples, there are engineering design documents (mechanical descriptions, software programs), patients' case-records in the field of health care, and contract documents in business circles, which are gradually transformed from business proposals into definite, formal, contracts; other examples are quality assurance documents, which are becoming increasingly digitized, management counselling assessments, and the free open source software forum (Gasser & Ripoche 2003)²...

The main characteristics of DofA can be defined as follows:

- Their extended state of incompleteness: they go through a long process of completion during the active collective semiotic production phase, during which we call them *evolving DofA* (as opposed to *stabilised DofA*);

² It is worth consulting the studies by Gasser (such as Gasser and Ripoche 2003) on the heterogeneity of the documentary contributions put forward at Free Open Source Software forums, in terms of the incidents reported: the quality of the software programs, how they work, the bugs with which they are beset, etc. This heterogeneity does not, however, prevent the coordination of collective actions from being fairly effective in most cases.

- Their perennality: this characteristic is due both to the participants' commitment to the semiotic content of these documents, and to the widely distributed nature of the transactions, which gives rise to specific documentarisation problems, and hence to storage and indexation problems;
- Their fragmentation: at least during the evolving phase, they contain several fragments which are often only loosely semantically linked (especially in the case of annotations), and which cannot be mechanically and implicitly integrated into the document (cf. above);
- The non trivial relationships between DofA fragments and their producers: the various parts of DofA are often produced by different authors (they can therefore be said to be plurivocal or pluritextual), who have different statuses in the transactional situation, and therefore have different rights to the semiotic product;
- The non trivial argumentative relationships between the document fragments: each fragment stands in a potentially complex relationship with the others, depending on the modes of expression used, the level of certainty or uncertainty expressed, and the logical links with the other fragments (such as the presence of contradictory statements), for example.

The special characteristics of DofA mean that they require new, more appropriate principles of indexing and classification corresponding to the digital micro-libraries designed for small organizations (although librarians and information science specialists are not yet very aware of this need). This would facilitate the “operational” information management activities, as well as contributing to the long-term “knowledge management” issues by making it possible to archive the various versions of DofA more efficiently. The purpose of indexing differs, depending on whether the context is that of an evolutive process subserving the cooperative activities of a relatively small collective, or whether it involves stabilised documents which can be consulted by a vast community of potential users. One of the main features of evolutive DofA is the fact that these documents go through a large number of successive versions, and during this process, their status evolves, as does that of the fragments of which the documents are composed.

These documents require a large range of literary and documentary techniques, depending on the level of standardisation of the transactional situation, which in turn determines the standardisation of the roles played by the participants and that of the format of their semiotic products. The following non-exhaustive list gives some of the main literary and documentary genres in decreasing order of standardisation: (1) questionnaires (2) standard plans (such as the systemic models used in engineering, or the standard outlines used to draw up legal contracts), (3) conventions corresponding to a stereotyped style of writing, such as that used in the descriptive and speculative texts produced in the scientific field, (4) the question-and-answer style used in internet forums, and (5) narrative documents, in which the emphasis is placed on the style, thus masking the underlying plan. In all these literary³ and documentary techniques, the respective roles of the explicit and implicit links differ, as does the overall level of integration of the document (a forum, for instance, make use of explicit links based on the thread of discussion structure, and seems to be less completely integrated than a technical document).

3 Symbolic communicational transactions: the transactional situation

To understand more clearly what DofA consist of, it seems to be necessary to take into account the fact that the production of these documents is a long-term process, as previously

³ We refer her to the concept of “literary technology” in the broadest sense, since even a form can be said to require a specific style of writing.

described in terms of the asynchronous exchanges involved in CSCW between the producers and beneficiaries bound together by common interests. In terms of the theory of “symbolic communicational transactions”, a document is regarded as being the object of transactions or exchanges between partners who commit themselves personally to participating and to providing the knowledge required to obtain an at least partly jointly produced “work” (Zacklad 2004).

As we previously suggested in the more restricted context of the “theory of intellectual transactions” (Zacklad 2000), transactions mediated by documentary substrates might be viewed as *pseudo-artefactual transactions* in which the vehicle used to mediate the communicational transactions is of a perennial kind. Transactions of this type can either involve individual participants or in some cases, they can be intended for a larger audience, the members of which are not individually known, in which case the transaction tends towards becoming of the “universalizing” kind. The documents involved, which used to be taken to include only written documents have been termed hot, lukewarm or cold, depending on the extent to which those engaged in the transaction are actively involved⁴.

Writing is only one of the ways in which these transactions are materialized, however. To analyse the specificities of documents as just one of the set of semiotic objects involved in the process of communication, it is necessary to take a look at how communicational transactions function in general at a whole range of levels, including the postural, gestural and vocal levels, to mention but a few. From this broader standpoint, the object mediating the transaction can be said to be a *semiotic product* created by a producer for a recipient in the context of a *transactional situation* which we have described at the specifically communicational level⁵.

The *transactional situation* (which can also be broken down in some specific cases into a semiotic production situation and a reception situation) includes the following components (fig. 1):

- One or several *producers*;
- One or several *recipients*⁶;
- The *parameters of the transactional situation*, where the terms *situation* and *context* are used as in the field of pragmatic communication analysis (Kerbrat-Orecchioni 1996), where they are taken to cover the following aspects:
 - (1) A *common project* based on common interests or objectives justifying participation in this collective situation. (2) *The social relationships* between the producer and the recipient, which partly determine the common interests and/or the goals pursued. (3) *The spatio-temporal setting and environmental conditions* liable to affect both the chances of reaching the goals and the semiotic production processes. (4) The choice of *medium*, which depends in particular on the spatio-temporal setting and the environmental conditions. (5) The *techno-informational* equipment available in the given spatio-temporal setting, which provides (a) external representations of the goals (b) documentary resources facilitating the

⁴ The extent to which a transaction embodied in a document is active does not depend on how recently the latter was written, since some communities have an extremely lively relationship with the texts they hold to be sacred.

⁵ Focusing on the semiotic aspects of the objects resulting from transactions, as we do here, should not make us forget that documents have other properties, including material ones. It is not possible to explain here why we have used terms such as “producer” and “recipient” instead of more classical terms such as those of “sender” and “receiver” used in Shannon’s transmission model. Let us just say that the mathematical approach to information used in the latter model is very different from the anthropological picture of semiotic objects we have adopted here. When the term “reception” is used to describe situations where the beneficiaries make use of the media and their content, the situation is more like “consumption” than “recording” according to the computer science acceptance of the term.

semiotic production process (c) perennial substrates associated with the medium, facilitating its circulation and dissemination. (5) *The participants' common and individual representational ground* (Clark 1996). (6) The *skills* of the producer(s) and the recipient(s) insofar as they are relevant to the situation in general and to the act of communication and make for efficient semiotic production via a given medium and efficient reception of the product transmitted via this medium.

- Lastly, ongoing *semiotic (co-)productions*⁷ can convey from the producers via a given *medium* the *semiotic content* intended for the recipients, while also providing means of updating and transforming the transactional situation (the joint project, the social relationships, the participants' skills and their representations, for instance).

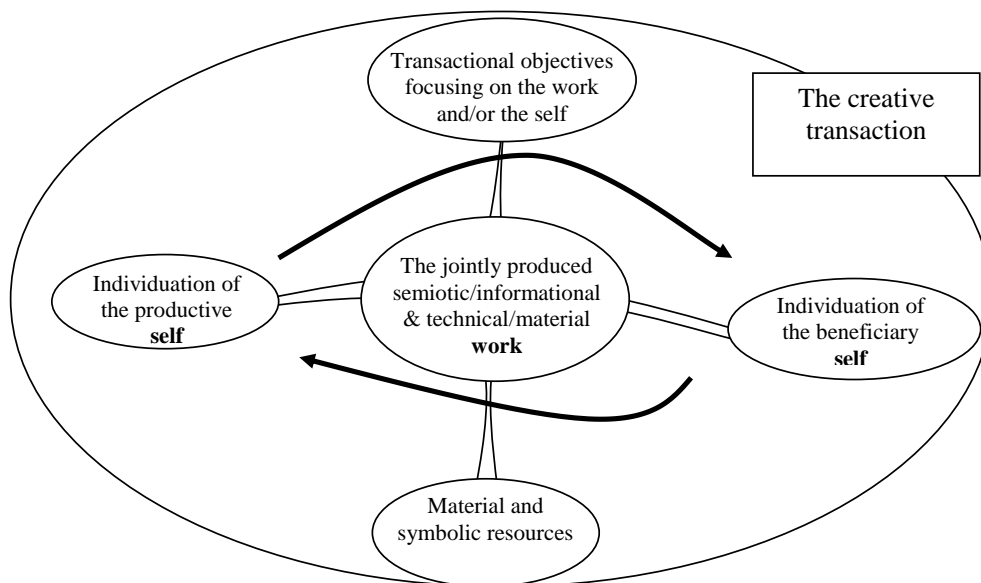


Fig.1. Diagram of the components of a creative transaction: the roles described here correspond only to the initial phase: in a complete transaction, the beneficiary self responds by adopting a symmetrical position conducive to joint semiotic production.

3.1 Components of semiotic products

In order to analyse semiotic products, it is proposed to distinguish between the expression and the substrate of this product or *medium of the semiotic product* on the one hand, and the *semiotic content* conveyed by this medium on the other hand. As we will see below, documents will be regarded here as semiotic products mediated by perennial substrates endowed with specific attributes.

The components of a semiotic product are therefore as follows:

- The *medium*, which can be decomposed, as mentioned above, into two parts:
 - The *mode of expression* adopted (spoken or written language, gesture, film, etc.), which is associated by convention with a system of signs which can be arranged in form syntagmatic and paradigmatic patterns;

⁷ When a transaction is highly standardised and its production highly codified, we speak about informational transactions.

- *The substrate used* along with this mode of expression, which has to be appropriate to its specificities (the human voice, physical gestures, printed paper or electronic systems in the case of written texts, etc.);
- The *semiotic content* (or meaning), which can also be decomposed into two levels, which can be defined as follows:
 - Its *evocative power*, which means its ability to trigger *common representations*⁸, depending on (i) how the signs are arranged, within the limits of the scope provided by the medium, and (ii) the parameters of the transactional situation (the *evocative power* is one of the aspects traditionally studied in the field of semantics). In some extremely standardised situations, the signs do not evoke representations, but directly trigger "automatisms", and the material and communicational aspects of the transaction can be said to merge (see below);
 - The *potential psychic and social effects* corresponding to the *possible effects* of evoking some representations, which prove the effectiveness of the communication process. These effects are variably predictable, depending on how standardised the transactional situation is, and involve updating the common ground and extending the "established semiotic content" between the participants, in a way which is publicly or officially recognized as having furthered the transaction⁹ (the *potential effects* are one of the aspects traditionally studied in the field of pragmatic linguistics).

In these definitions, it is worth noting that a distinction is made between the mode of expression chosen and the corresponding medium: this distinction is of some importance, as we shall see below in our document analysis.

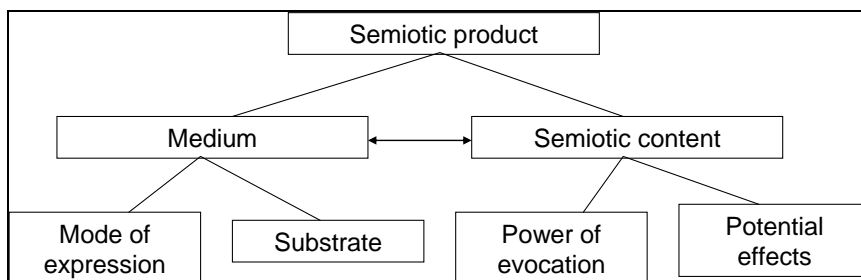


Fig. 2: Components of the semiotic product

3.2 Distribution of transactions in a heterogeneous spatio-socio-temporal framework

Since these collective activities are so widely distributed, the producers and recipients of communicational transactions do not all belong to the same spatio-temporal framework. This means that the documents produced must have a sufficiently long-lasting form, so that they can be initiated, interrupted, updated and repeated in all the possible configurations

⁸ The concept of common representations corresponds to the concept of "common ground" defined by Clark (1996). Clark (cf. p 94), referring to Lewis (1969), this concept corresponds to the information possessed by the participants, including what they believe, know, assume, and are aware of, which in turn has been discussed in terms of mutual beliefs, mutual knowledge, mutual assumptions and mutual awareness. One of the advantages of the concept of "common representations", which relates more to the field of cognitive psychology, is the fact that it refers to the information reconstructing cognitive processes occurring in the context of communicational transactions. "Common knowledge" links up more with the concept of "communal common ground", where information is shared among more widespread communities whose longevity is ensured in particular via a process of cultural reproduction.

⁹ This corresponds to Clark's "Discourse Record".

involving the presence or absence of the producers and the recipients. On the other hand, in some contexts, distant producers can replace the initial producers who started off the transaction, and take over their role. In cases of this kind, which occur quite frequently in complex organisations and in economic spheres, we speak about the *spatio-socio-temporal distribution of transactions*.

In the broad socio-psycho-economic theory of transactional activities we are attempting to draw up, the media produced and exchanged in transactions have other aspects apart from the semiotic ones. If the objects produced by the actors are considered as being media, it is because they *mediate* the relations between the actors involved and turn them into transactions. They do not only convey linguistic meaning, however. The other important aspect of these media is their material dimension, which produces effects of a more physical or sensory than psychic nature (the latter term is intended to cover both the cognitive and affective or emotional effects).

Although the two main components described above are always present, since these media always require a material basis, if the semiotic effects predominate at the expense of the material ones, as occurs in the case of written and spoken language production, we can speak about semiotic medium as opposed to material one, or about objects, in which the opposite dimension predominates¹⁰. Symbolic objects also have a material side, which corresponds to the effects incidentally exerted by *the physical substrate* of which they are composed on the sensory organs. The perenniality of the substrate will also contribute to an extension of the semiotic function, and this fact plays an important part in documentarisation processes, as we will see.

In the context of transactions where the products, which are mainly of a semiotic nature, are mediated at a symbolic level (as occurs with communicational transactions), there exist various ways of distributing the transaction effectively throughout a heterogeneous spatio-socio-temporal setting. The following list gives eight of the possible ways: (1) *standardising the transaction situation*, (2) *formalizing the mode of expression*, (3) *mnemotechnic ritualisation* (4) *encouraging abstraction*, (5) *substitutive mediation*, (6) *documentarisation*, (7) *increased recourse to techno-informational equipment*, and (8) *substitutive coordination*. These various means are not mutually exclusive and are often complementary. In contexts where the transactions mainly involve *material equipment*, other strategies such as automation, regulating specific aspects or conservation can be used to ensure effective distribution. In this paper we will study in more details the four last strategies, substitutive mediation, documentarisation, increased recourse to techno-informational equipment and substitutive coordination.

3.3 Substitutive mediation and documentarisation

Substitutive mediation focuses on the medium on which the semiotic production process is based. Rather than determining the mode of expression used and its degree of formalization, however, this method deals with the *material substrate* (which is not without feedback effects on the mode of expression used). Direct perception of the semiotic production process by the subject's own body is replaced here by an indirect mode of perception involving the *transcription onto a writing substrate* or *the automatic encoding of one of the physical sources* conveying the signals forming the semiotic product onto a different substrate.

Material substrates can be classified as being either ephemeral or perennial. *Ephemeral media* are characterised by the fact that the stimuli they convey can have transient effects on the recipients' sensory organs, especially due to the fact that the form given to the

¹⁰ We have classified material substrates and objects in various categories, depending on whether they are real estate (buildings, shared premises, etc.), items of clothing or furniture, consumable goods (food, fuel, etc.), or technical equipment (machines).

substrate does not durably change it (this can be said of the air, which is the ephemeral substrate conveying speech and of the light flux informing recipients about the gestures made by their partners in face-to-face interactions).

Perennial vehicles (media), on the contrary, keep the form they were initially given, which makes it possible for the recipients to repeat the effects elicited by this form on their sensory organs. When the recipients are able to control these substrates, they can manage the conditions under which the stimuli have access to their sensory organs after either short periods of time (re-reading a few lines or re-viewing part of a film on personal digital equipment) or longer periods (going back to a document after several days, weeks or years) have elapsed.

There are three possible substitutive mediation strategies: *transcription, the automatic coding of a physical source, and the recording of encoded* semiotic products. These strategies can be used to distribute semiotic products and in some cases, to preserve them for long periods of time. Transcription is one of the practices involving writing, and it is based on the use of a graphic code which has to be mastered by both the writers and the readers. The automatic encoding of a physical source serves to convert a physical form corresponding to a given mode of expression (sound or light) in order to transfer it more easily onto an other substrate before decoding and reproducing it for the recipient's benefit. Recording makes it possible to save the physical signals encoded onto a perennial substrate. The automatic coding of a physical source can convey a semiotic product to distant recipients without the medium used for the transmission having to be particularly perennial, as in the case of a telephone call. In some cases, as in that of the retransmission of a previous radio broadcast, the substrate used is perennial on the side of the broadcaster but not on that of the listeners.

By selecting a physical source associated with a mode of expression (the human voice, visual images, kinaesthetic impressions, etc.), substitutive mediation processes tend to yield rather impoverished semiotic products in comparison with the great potential offered by face-to-face situations (because multimodal channels yield larger numbers of redundant messages). In some cases, the advantage of substitutive mediation can be the fact that it shows up attributes which are assumed to be of particular relevance as sometimes occurs in the case of writing. Lastly, especially in the case of transcription, they can be used in parallel with the modes of expression used when both the producers and the recipients are present, as occurs when somebody draws diagrams on a board during a meeting.

Documentarisation is an extended version of substitutive mediation, which occurs when the substrates used are perennial. It consists of endowing the substrates with *specific attributes* making it possible: (i) to manage them along with other substrates, (ii) to handle them physically, which is a prerequisite to be able to browse semantically among the semiotic content, and lastly, (iii) to guide not only the recipients, but also the producers themselves to an increasing extent, around the substrate by providing one or several maps of the semiotic contents. Since this is one of the main points on which this paper focuses, we will describe below the various processes involved in documentarisation.

3.4 Extension of the use made of techno-informational equipment and substitutive coordination

Extension of the use made of techno-informational equipment, which has been accompanied by the development of the substitutive mediation and documentarisation strategies required to specifically adapt the new techniques to dealing with communicational transactions and semiotic production tasks. Techno-informational equipment serves the following three main functions: (1) it provides external representations of goals and of work organisation and procedures; (2) it provides documentary resources which are separate from the semiotic production process, but which contain data liable to assist these processes (3) it facilitates the management of the substrate carrying the semiotic content, especially as regards

the handling of the explicit links between the various fragments (see below), while facilitating their distribution and their diffusion. This equipment itself is based on technical aids facilitating the management and creation of paper documents (filing cabinets, books, files and office equipment) and their digital counterparts, based on the use of the latest information and communication technologies.

Substitutive coordination results from the automation of the tasks performed by techno-informational equipment. In some highly standardised situations, the automation of the procedure and the digitising of the semiotic production equipment have resulted in quasi-automatic systems of transaction (such as the on-line booking systems available via the internet) based on workflow models¹¹. In cases of this kind, the transaction is mainly based on the exchange of information, which corresponds in our opinion to a two-fold transformation: (1) it decreases the social interactions between the partners involved in the transaction and their levels of commitment, and (2) reduces the “symbolic” aspects of the semiotic content in favour of a more mechanical level of expression and potentially standardised effects¹² (Zacklad 2005b). In those cases where the nature of the transaction undergoes a radical change of this kind, the computerization/automation coordination strategies are no longer applied to widely distributed communicational transactions, but to the substitutive mechanisms specific to *informational transactions*.

In the context of the cooperative activities on which we are focusing here, where standardisation has not exhausted the potential for communication, the substitutive coordination strategies correspond to those described in the field of CSCW (Computer Supported Cooperative Work) and Knowledge Engineering studies. In line with the functions performed by techno-informational equipment, substitutive coordination contributes, for instance, (1) to the automation of some of the stages in “coordination procedures”¹³ (automatic warnings can be emitted to those in charge, for instance, depending on the state of the semiotic product, for instance), (2) to the automation of some kinds of information retrieval, depending on the requirements detected (3) and to the indexation of links between the fragments of semiotic products, depending on the state of progress achieved.

Some CSCW projects have contributed, for example to the development of *substitutive coordination* functions which are based either on an analysis of the activity of the actors involved in a transaction (systems supporting *mutual consciousness*, Heath & Luff, 1992, Dourish & Belotti, 1992), or on a partial formalization of the semiotic product (*Web Semantic* approaches, see Tim Bernes Lee & al. 2001). Our own analysis of the concept of Documents for Action was intended in particular to facilitate the setting up of coordination strategies based on the use of techno-informational equipment, as well as substitutive coordination strategies, when they are relevant.

¹¹ Here we are referring to the automated coordination mechanisms described by C. Simone and K. Schmidt (1996).

¹² An informational transaction could be said to be a material transaction, where the matter produced has no intrinsic energy value and involves the use of a pre-established code. Transactions of this kind are often intended to provide registers or databases with information for coordination purposes, but not for the sake of communication in the strongest sense, which means co-constructing a situation and commitment to a symbolic target. Note that face-to-face interactions involving no personal commitment of this kind are also more informational than communicational; whereas semiotic production activities which are carried out in isolation but which have a high potential for interpretation (or a high symbolic potential) can be classified as “communicational” because of the author’s high level of commitment and the large effort of interpretation required on the part of the prospective recipients.

¹³ As defined by Schmidt and Simone 1996.

4 Processes and means of documentarisation

4.1 Transcriptions and recordings

As we mentioned in the Introduction, it is proposed to focus mainly in this paper on the strategy of documentarisation and the ways in which techno-informational equipment can be used for this purpose. There exist two main methods of conveying a semiotic product via a perennial medium, namely *transcription* and *recording*. In the former case, graphic signs with logically codified visual (pictogram) or phonetic (phonogram) relationships are transferred onto the appropriate material substrate, for example. The most frequently used codified graphic signs are those used in many systems of *writing* to produce “texts”. Transcription involves the use of a specific system of signs, and hence the transposition of the semiotic content into another mode of expression, which can sometimes affect its powers of evocation and its potential effects, whereas recordings seems to have less pronounced effects on the semiotic contents of the objects on which the transactions focus. However, this difference is possibly less profound than it may seem. Although the initial cost of transcriptions may seem to be higher than that of recordings, the risk is incurred in the latter case of obtaining a huge body of material which cannot easily be used and is more difficult to documentarise, especially when it comes to mapping the semiotic contents onto the medium (table of contents, indexes, etc.).

To ensure the efficiency of the transactions involved and for reasons inherent to the documentarisation process, recordings often require the use of filming strategies and the mounting or editing of the micro-transactions recorded, which have to be made perennial. Just as transcription affects the semiotic content, recordings, which have to be selective in order to be efficient, also affect the content in comparison with situations where the transaction occurs synchronously via an ephemeral substrate.

Lastly, new complex hybrid forms of substrate are continuously developing in the digital field, where the material does not serve only to reconstitute texts while making them look as similar as possible to the original paper versions, for example, or to define “direct manipulation” languages based on icons, or make use of virtual reality interfaces which, although they looks like faithful recordings of reality, are in fact completely artificial constructs in which new modes of expressing the semiotic contents are used.

4.2 Definition of documents and the dual external/internal documentary articulation

As we have seen, transcription and recording procedures are prerequisites for successful documentarisation processes, but they do not suffice for this purpose. Personal note-taking or an occasional recording intended to facilitate a semiotic activity in a given transactional situation can also occasionally be useful. However, if the *documentary investment* required by the process of documentarisation has not been made, it will not be possible to go back to using these expedients in subsequent distributed transactional situations. In other words, it is possible to produce transcriptions or recordings as means of *substitutive mediation* using perennial material substrates, which do not necessarily yield documents with the precise meaning we have been attempting to define here.

In line with our definition of the documentarisation strategy, a document will be taken to mean *a semiotic product transcribed or recorded on a perennial substrate, which is endowed with specific attributes intended to facilitate the practices associated with its subsequent utilization in the framework of distributed communicational transactions*. These attributes make it possible for the document to move through time and space among the

communities of interpretation, with a view to prolonging and extending the communicational transactions initiated by its producers. These *heuristic attributes* support the interpretation processes and contribute to producing the dual documentary articulation. As we will see below, the concept of semiotic production tends to exclude, or at least to relegate to the very edges of the documentary field, the production of automated data making use of *standardized attributes*, since transactions associated with data of this kind are held to be of the informational rather than the communicational kind.

To proceed with our analysis of documentarisation strategies, it is now necessary to look more closely at the diverse practices associated on the one hand (i) with the external management of the documents stored along others in *libraries, archives, filing cabinets, administrative, technical and documentary databases of various kinds* (large or small, private or public, handling digital or purely paper substrates, including variably heterogeneous semiotic products in terms of their material form, their genre, etc.) and on the other hand, (ii) with the internal management of the documents forming a set of micro-semiotic products, which can vary considerably in their size and in the diversity of their modes of articulation.

In order to ensure that it will be possible to handle the first method of document management, they have to be endowed with a number of attributes with which they can be semantically articulated with other documents (*external articulation*). These attributes are those with which a document can be dated and located, its producers (the authors) and recipients (the readers) can be identified, and its semiotic contents can be briefly summarised, etc.

To meet with the requirements of the second method of document management, the attributes with which documents are endowed have to be of a kind which make it possible to decompose a document into coherent parts (the title, spacing, index, etc.), to highlight certain expressions so as to guide readers semantically around the semiotic content (sub-titles, typographic differences, etc.), or to refer them to other semantically relevant places (the references, index, footnotes, etc.). These attributes, which are part of the *internal semantic articulation*, constitute a system of orientation enabling the recipient (the reader in the case of a written text) to browse semantically through the document.

4.3 Implicit and explicit semantic links between fragments of a document

The use of a perennial substrate mediating the circulation of semiotic contents will also make it possible to inscribe or record an enormous number of signs, or even possibly many separate communicational transactions, on the same physical substrate. Underlying the main transactional project summarised by the heading of the document, there will always be a large number of transactional sub-projects, all corresponding to documentary fragments which are variably closely linked together without their diversity necessarily being explicitly expressed. The need to provide readers with means of semantic orientation within a document therefore raises the complex question as to how to link together the fragments of a document and what mode of linkage should be used for this purpose.

Implicit links are those serving to connect together fragments of text, using the various planning strategies on which the producer's transactional project is based, whether these strategies are of a temporal, structural or functional kind, for instance. They also make use of all the implicit relationships authorised in the sharing of a common representational ground, which is developed and enlarged as the transaction progresses. This fragmentation is carried out in the way which seems the most natural, while apparently giving the readiest implicit path of access to the semiotic content.

The explicit system of orientation which parallels and complements the former system either consists of explicitly presenting the initial browsing plan (in the form of sub-titles or

Tables of Contents, for instance), or suggests other more unexpected projects, a priori (indexes, tables of references, etc.) Systems of the latter kind are usually based on a whole set of terminological and ontological resources which are organised differently from “Tables of Contents”: they are usually defined on a more general and more systematic basis or adopt a particular starting point, such as the names of the authors quoted in a literary text. Setting up explicit systems of orientation always requires a considerable amount of investment, but they can also give a document a great deal of added value, since they give it greater transactional flexibility.

The use of these two kinds of links is more natural in the setting of the internal articulation defined above. They can also occur, however, in the framework of external articulation, especially in the case of documents belonging to collections or that of small documents placed in files. A project to set up a collection may include, for example, the creation of implicit links between volumes, which can possibly be paralleled by a more explicit system of codification or by the possibility of consulting a general thesaurus which can be used as a systematic guide to the semiotic production process.

5 Emergent communicational transactions in fragmented documents: DofA and annotations

5.1 Smooth and fragmented documents

A document, in the form of a single transaction project summed up by its title, will not achieve the objectives set until a possibly very large number of arguments have been put forward, each of which constitutes a separate micro-communicational transaction representing a step towards reaching the overall objectives of the main project. In the case of a technical document, the length is often justified by the need to put forward detailed arguments in response to the potential objections liable to be raised by the future recipients.

The “smoother” or more unified a document seems to be, the more implicit the various components of the discourse corresponding to micro-communicational transactions will be, since the presuppositions authorised by the sharing of a common representational ground make for a natural sequence of arguments. Each literary approach corresponding to a genre privileges a particular implicit type of semantic link between the fragments.

Documents of other kinds, on the contrary, will look more fragmented, since the various micro-communicational transactions of which they consist have been explicitly linked up using a system of numbering, sub-titles, or a set of specific attributes announcing the status of the fragments in the document and their relationships with the surrounding fragments. Extreme cases of fragmentation can occur in a special class of documents playing an essential role in the coordination of distributed communicational transactions: those we have called “documents for action”.

5.2 Emergent communicational transactions in cooperative activities

Although the distribution of communicational transactions through the DofA had no real equivalent among the cooperation technologies available before the media’s substrates became intensively digitised, it can be said, at least at the metaphorical level, to bear some resemblance to the communicational transactions involved in synchronous, face-to-face cooperative activities. In these situations, which arise, for example, during work meetings, the participants can suggest solutions to problems, discuss contradictory points of view and put

forward arguments in the framework of polylogal interactions, assisted or not by collective visual substrates such as blackboards.

In polylogal interactions, the communicational transactions are processes of the emergent kind. In these contexts, the transaction situation is liable to be quickly “re-configured”, especially in terms of selecting the participants involved in the transaction process, since the presence of these persons is either explicitly or implicitly ratified, whether they are present or absent, and whether they are real persons or abstract entities (a collective entity, for example). Likewise, the possibility of the participants expressing themselves in terms of “we” can be said to depend on the possibility of quickly defining a collective entity corresponding to a common self with a more or less clearly specified scope. On similar lines, the use of implicit expressions or indexical signs to refer to various components of the environment will tend to make the semiotic content ambiguous if it is transferred to other contexts. A semiotic transaction initiated by a participant in a polylogal interaction situation is liable to give rise to several interpretations, corresponding to the various ongoing virtual micro-transactions in which the participants feel they are engaged, depending entirely on the reactions elicited in the other participants.

In face-to-face polylogal interactions where the participants are actually physically present, the latter have to make constant efforts to interpret the transactions on the basis of what they know about the components of the transactional situation and their own communicational skills (in line with Grice’s principle of relevance, 1979) in order to disambiguate the transactions. These transactions will be all the more flexible and potentially successful if the participants are placed in a homogeneous spatio-socio-temporal setting making it possible for them to continuously correct any errors of interpretation they make. In the context of transactions mediated by DofA, it will be necessary to set up appropriate mechanisms to facilitate the emergent transactions triggered by the technical set-up, which do not benefit from the same advantages as those available in face-to-face interactive situations. Annotative strategies are one of the main mechanisms used for this purpose.

5.3 The role of annotations in DofA

The main problem with which the members of groups co-producing a DofA are confronted is the lack of information about the transactional context associated with a proposed fragment corresponding itself to a transaction bid. To contribute to a DofA, they deposit *free fragments* associated with various moments of a communicational micro-transaction on a perennial substrate. A fragment is taken to be complete if the participants perceive it as a coherent micro-transaction (an uninterrupted utterance, for example), and incomplete in the opposite case. The relationships between a fragment and the *main semiotic product* built up in the framework of the transaction are quite variable. In face-to-face communicational transactions, for example, some micro-transactions are regarded as digressions, or unsuccessful attempts made by some participants at orienting the collective co-semiotic product in a particular direction.

In the context of distributed communicational transactions involving the use of perennial substrates, the contributions take the form of fragments, which are articulated with the main semiotic product (the main text, in most cases) with varying degrees of success. When the status of free fragments has not been clearly established, they constitute accessory semiotic products. These fragments will gradually be either discarded or included into the main DofA according to a process of documentarisation whereby they are taken up and articulated by working either on the mode of expression used or on the semiotic content. However, if free fragments are not properly articulated together as soon as they are inscribed on the substrate, the uptake process will not be possible and the DofA will not be able to efficiently sustain the emergent distributed transactions involved in the cooperative activity.

The best way of articulating a free fragment with the other parts of a document is to produce annotations explicitly stating the nature of the link between each fragment and the main semiotic product, either when it is first inscribed or recorded on a material substrate, or at a later stage. Just as transcribing or recording a semiotic product on a perennial substrate does not suffice to obtain a document, a free fragment will constitute an annotation only if it has undergone a process of documentarisation. We therefore define an *annotation* in the strongest sense of the term as a *documentarised fragment of a semiotic product, i.e., one which is endowed with specific attributes with which it can be explicitly linked up with the other components of the document*¹⁴. The work of annotation, which is not to be confused with simply depositing a free fragment on a perennial substrate, therefore requires specific efforts making it possible to re-utilise fragments for either individual or distributed collective purposes, since they will contain traces of the transactional context associated with their production¹⁵.

Annotations are characterised by the fact that they are more or less explicitly *anchored* to part of the substrate, thus reflecting their variably close relationship with the semiotic content. The naming of the author of an annotation is also part of the documentarisation process, along with all the other variably explicit traditional modes of linkage (specifying the date, the place, etc.).

Lastly, it is worth noting that there are also several ways in which fragments can become annotations (cf. Zacklad & al. 2003). They can either (1) take the form of a proposal destined to be integrated into the main semiotic product by either substituting it for another fragment or adding it on, or (2) they can be designed to elicit other semiotic products, to express criticisms or to raise questions without necessarily being intended to remain part of the main semiotic product, or (3) they can be intended to constitute a *permanent annotation*, providing a relevant, perennial commentary on the main semiotic production process, in which case they are inscribed in a pre-allotted part of the material substrate.

The status of annotation also depends on the stage reached in a document's life-cycle, and even more strongly on the status of its producers. For example, a fragment contributed by an author having complete control can be integrated directly into the main semiotic product, by linking it up either implicitly (by simply adding it to the end of the text, for example) or explicitly (by numbering or referencing it, for example). In the former case, (where an authorized author forms a legitimate implicit link showing that his contribution is part of the main semiotic product), the fragment does not even go through the annotation stage. In the opposite case, where the contributor has less authority, the contribution may take the annotative form until the collective as a whole has decided whether it should become part of the main semiotic product. This requires making use of an attribute labelling the fragment as an exogenous and possibly temporary contribution, as occurs when the colour code function provided by word processors is used to signal changes made in a text.

5.4 Example of documentary investment in newsgroups

The semi-automatic editing and subsequent handling of annotations require *codifying* the attributes serving either as means of external articulation between the fragment and the DofA (anchoring or numbering, for example), or as a means of internal articulation with parts

¹⁴ This definition is not in contradiction with the definition for annotation recently proposed by Bringay, Carry and Charlet (2004), namely the trace of the mental representations evoked by the target. Our own definition is more stringent: annotation in the proper sense of the word means a form of documentarisation required to sustain distributed activities associated with documents.

¹⁵ A fragment written for annotative purposes which cannot be re-used by its potential recipients after its creation, for lack of documentarisation (the anchoring links are not sufficiently clear, the author is not specified, the significance is too vague, etc.) – could at best be said to be an *annotation in the weakest sense of the term*.

of the semiotic content, by replacing tacit links by more explicit ones (for example, using meta-data to typify the nature of the annotation). The process of codification requires a set of predefined resources (a codification database) based on (1) official administrative data (such as the participants' names), (2) ad hoc modelling efforts providing lists, thesauruses, ontologies, etc., (3) data automatically generated by a "function" in the mathematical sense of the word (as often occurs with the date or serial numbering).

Setting up a codification resource database or an indexing resource database (thesauruses or ontologies) and codifying the instances of the transactions with the help of these databases, requires investing in special documentary efforts. The quality of a resource database will determine how easy the classification procedure will be to use subsequently in comparison with ad hoc descriptive methods. The returns from this investment will be perceptible when it comes to using the document (retrieving it or finding one's way around its semiotic contents), since the cognitive cost of these operations will be reduced. In some cases, the cooperation technologies will make use of this codification and further facilitate the cooperative activities, by making it easier to retrieve and filter documentary fragments of general interest, for instance. It will sometimes even be possible to partly automate some aspects of the work involved in codifying fragments, thus appreciably decreasing the documentary investment required on the part of the users.

This is exactly what happens with the systems of annotation available in word-processing programs with which it is possible to automatically codify annotations in terms of a few standard attributes, such as the name of the author, the date, anchoring data, a system of numbering, etc. However, there exist other cooperation technologies which are not necessarily always perceived as annotative documentary technologies, but which nevertheless have several of the features in common with the latter. I am referring here in particular to two technologies which have been studied in detail, namely electronic mail systems, which are based on an epistolary metaphor, and newsgroups, which are based on metaphoric participation in a discussion group.

In the case of newsgroups, which constitute a particularly large class of DofA, the perennial nature of the material substrate used and the fact that it is provided on a common server makes it possible for all the contributors to add fragments of text at any point in the ongoing "discussion" (in a thread), but not to choose a specific anchorage point for a particular fragment within the text. The semantic articulation of the various annotative fragments occurs via a process of codification: specifying the author's name, the date, repeating the title of the original contribution in the response, hierarchically ranking the points in the thread of the discussion, and in some cases, proposing stereotyped models for questions, commentaries, etc. (see fig. 3 and tab. 1).

However, although newsgroups have been described as long-distance dialogue systems, detailed studies have shown that these systems only vaguely resemble traditional models for face-to-face conversation between several speakers (Lewkowicz & Marcoccia, 2004). As often occurs with breakthrough innovations, newsgroups had no real equivalent before the development of digital documentary techniques. It is worth noting on the other hand that transactions mediated by newsgroups are insufficiently codified for their semiotic contents to be re-used in a widely dispersed spatio-socio-temporal framework, i.e., to be properly understood by participants other than the initial authors of the contributions themselves. In conclusion, it is proposed to suggest some future lines of a socio-informatics research program (combining CSCW and Knowledge Engineering) which would make it possible to improve current cooperation technologies through a more fine-grained understanding of the associated transactional mechanisms involved.

Documentarisation for external articulation of the DofA among other DofAs in the newsgroup database

Explicit system of orientation (explicit semantic linkage of fragments/annotations for browsing into the DofA)

Documentarisation for internal articulation of the fragment (with codified & non codified attributes on the perennial substrate)

Annotation = documentarised fragment (fragment + attributes)

Implicit semantic linkage with the semiotic product from Laurent (contribution aiming to promote the Stylus Studio tool)

Documentary fragment corresponding to transcribed semiotic product from Martin

Fig. 2: Example of DofA based on newsgroup technology ¹⁶

¹⁶http://groups.google.com/group/comp.text.xml/browse_frm/thread/b0c140627f3b474d/42196d8c72bb8fa1?tv=1#42196d8c72bb8fa1. See also Sack & al. in this volume about the importance of quotations in newsgroups.

KIND OF TRANSACTION	ACTORS			
	Laurent	Martin	Stylus Studio Team	Maik
Asking for help	Annotation asking how to valid an XML doc with an XSD schema			
Providing suggestion	Annotation suggesting to look for an Eclipse plugin			
Pseudo-support aiming to give a related information	Annotation promoting a commercial tool providing some of the desired fonctionnality			
Providing suggestion	Annotation suggesting the use of an other tool			

Tab. 1: Some of the transactions corresponding to the example of DofA (line: actors, column: kind of transaction, cells: semiotic products corresponding to the DofA fragments).

6 Conclusion: new socio-technical systems for the management of codification databases, socio-semantic web and semiotic ontologies

In CSCW and Knowledge Engineering research, cognitive and social processes are used to define new functional characteristics for cooperation technologies, which in turn has generated some new working hypotheses about communicational transactions and the conditions under which they are carried out, thanks to (i) the systematic, detailed descriptions of situations for drawing up new scenarios for the use and (ii) assessments of the use of prototypes designed on the basis of these scenarios..

Lewkowicz & Marcoccia (2004), for example, have suggested a new attribute which can be used for the external semantic articulation of a fragment in a newsgroup, depending on whether the recipient of a proposed micro-transaction is a single officially recognised participant or the whole collective involved. Using this new attribute can suggest new ways in which man/machine interfaces can intervene in newsgroups as well as new ways of displaying previous micro-transactions. One of the aims of the Médiapro and Médianotte projects (Zacklad & al. 2003) was to propose new attributes for integrating annotations into DofA, on the following levels: that of the “micro-organisation” (the author, his or her status, the date, the title of the ongoing project, etc.), that of the “domain knowledge” (the professional spheres to which the annotations corresponding to a thematic index relate), and that of the “argumentation” (formulating constraints, suggestions, criticisms, assessments, etc.).

The Tech-CICO laboratory has been studying the question as to how a collective working on a common project can set up a codification database, which has led to the development of the Socio-Semantic Web (W2S) research project. This project, which is complementary to the Semantic Web project, which focused mainly on defining universal, entirely standardised “formal ontologies”, was intended to provide highly flexible codification databases which meet the changing requirements of local communities of users. Instead of formal ontologies, the W2S project favours the use of *semiotic ontologies* (Zacklad 2005b) which set up an *interpretative* relationship between both the semiotic concepts and the situations for which they stand, and the “mutual connotations” conveyed by semiotic concepts within a corpus in a multiple viewpoint setting¹⁷. The use of DofA, which are intrinsically uncompleted documents expressing the contrasting points of view of various communities of

¹⁷ These semiotic ontologies can be handled using standards such as "HyperTopic" implemented in the Agorae platform (see for example Cahier & Zacklad 2002, 2004). This is a tool designed for the evolutive management of semiotic ontologies by various communities of users.

users, seems to call for these new methods of codification, which can be less computable but coming much nearer to meeting the requirements and matching the practices of communities of users.

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