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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 in 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 of documentarisation processes, several novel concepts are introduced and used to describe Documents for Action (DofA), their characteristics and the conditions that should be respected for correctly annotating them.

Key words: document, Document for Action (DofA), documentarisation, annotation, cooperative writing, newsgroup

1. The advent of digital documents: An economico-managerial, CSCW and knowledge engineering approach

Internet and intranet development of the Web 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 produced through the writing process, we previously defined the concept of Documents for Action

(DofA, Zacklad, 2004). These documents have properties (their prolonged state of incompletion, 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 are often published before they have been completed and are constantly updated by adding annotations.

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 work 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 digitisation 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 articulation*, and the *implicit and explicit semantic connections* between fragments of documents.

These concepts make it possible to precisely define 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 achieve the common goals of a distributed collective practice. This approach will then be used to analyse some cooperation technologies, focusing in particular on newsgroups, which we consider as being typical of an annotation activity. We conclude by underlining the importance of codification in documentary investment processes, and define the conditions making it possible end efficient.

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

2.1. HYPERWRITING AND HYPERFRAGMENTING

Documents have traditionally been defined by reference to conventionally written texts but this is changing (cf. Briet, 1951; Brown and Duguid, 1995; Buckland, 1997; Pédauque, 2003). We will define them as a physical substrate used to organise 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. In this context, digitisation tends to break down the frontier between the intern and the extern, between the organization's intranet and its internet connections. But we have come to realise that our approach can also be applied to a wide range of document types which serve more "cultural" purposes as well. What is breaking down the reference to documents as conventionally written texts is the fact that they are increasingly being written at the same time as they are being read. This simultaneity of the reading/writing process can be observed in many uses 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 is consequently necessary to both redefine the concept of *documents* and those relating to their content. It is worth noting that documents no longer fall uniquely into the category of written texts, since they often include images and sounds which are picked up by a whole range of new browsing and player systems.

The main outcome of these new collective writing practices is that the production phase of a document continues indefinitely. For an appropriate understanding of documents in our day and age, it is just as important to define them in a way which accounts for their indefinite, on-going production as it was in the early 1950s to consider them as tangible, self-defined objects. (Briet, 1951). If we wanted to add yet another neologism to an ever-increasing collection, we could speak of hyper-writing. Hypertext focused attention on the conditions of hyper-reading. Digitised Documents for Action focus attention on hyper-writing: how are simultaneously evolving *fragments of documents* drawn together and made coherent through the collective activity which 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 an intellectual kind, the intermediate or final product of the cooperative process is a semiotic product. This product can itself be the starting point for further transactions on a larger spatio-socio-temporal scale. The teams engaged in these cooperative activities are generally structurally open (Zacklad, 2003a) and widely distributed in spatio-temporal terms. Their work environments are increasingly digitised and networked and a techno-informational infrastructure is under development for supporting documentarisation strategies. Word processors are a good example of equipment being plugged into that infrastructure. Not only can they be used to make annotations but they are being integrated into electronic mail systems as well.

In order to understand how this infrastructural support for creating "Documents for action" (DofA) plays out in organizational terms, it is important to recognise that DofA bring together and make coherent semiotic products that are produced in a great many separate but highly interdependent situations. Some examples of DofA taken from different professional contexts are engineering design documents (mechanical descriptions, software programs); patients' case-records in the field of health care; business proposals which are gradually transformed into definite, formal, contracts; digitised quality assurance documents; management counselling assessments; and even the free open source software forums described by (Ripoche and Sansonnet, 2006) in this volume.

The main characteristics of DofA can be defined as follows:

- Their extended state of incompletion: 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*);
- Their perenniality: 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 indexing 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.

New principles of indexing and classification are required in order to build digital micro-libraries for managing DofA in small organizations (although librarians and information science specialists are not yet very aware of this need). The goal of defining these principles is both to facilitate "operational" information management activities and to contribute to long-term "knowledge management" by archiving successive DofA versions of an on-going collective activity. The purpose of indexing differs, depending upon whether the digital library is being designed to support the activity of a small group whose work together is evolving rapidly, or whether it is being designed to enable a vast community of potential users to use a set of stabilised DofA. One of the main features of evolutive DofA is that they go through a large number of successive versions, and during this process, their status evolves as does that of the individual fragments composing them. Indexing and classifying DofA will depend upon the level of standardisation of a transactional situation as we will show now in our discussion of this concept.

3. Symbolic communicational transactions: The transactional situation

As said above, we consider documents to be the physical support of transactions or exchanges between partners who commit themselves personally to participate and to provide the knowledge required to collectively do things together. In our "theory of intellectual transactions" (Zacklad, 2000), these transactions were called *pseudo-artefactual transactions* because interpersonal communications are mediated by a perennial support. 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 "universalization". 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 involved.[1] However, writing is only one of the ways in which symbolic transactions are materialised. A more general framework including such things as voice, gesture and posture mediated exchanges is required in order to fully understand how communicational transactions function. From this broader standpoint, the object mediating the transaction can be said to be a *semiotic product* which is

created by a producer for a recipient in the context of a *transaction and which serves for exchanging knowledge*.[2]

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

- One or several *producers*;
- One or several *recipients*;
- The *parameters of the transactional situation*, where the terms *situation* and *context* are used to mean the same as in the field of pragmatic communication analysis (Kerbrat-Orecchioni, 1996); These parameters are the following:
  (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 semiotic production process (c) perennial substrates associated with the medium, facilitating its circulation and dissemination. (5) *The*

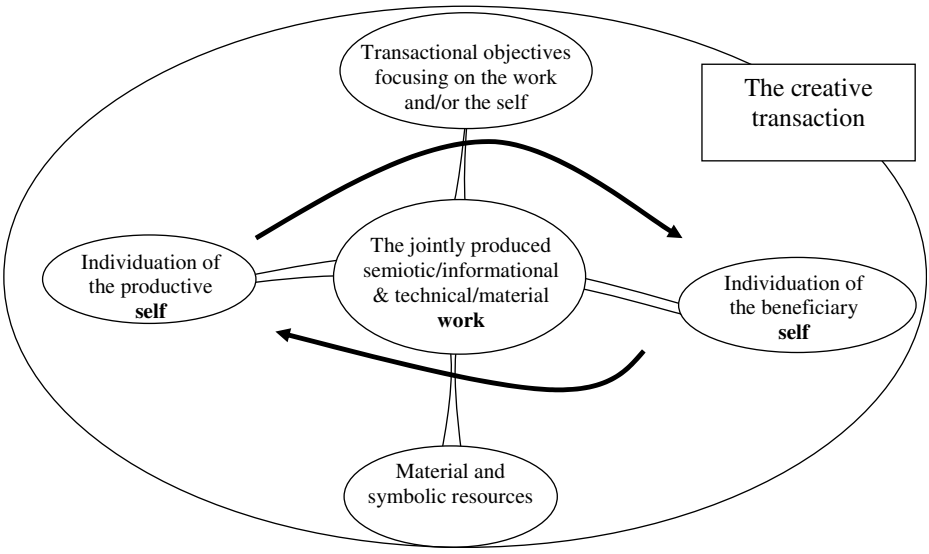

Figure 1. Diagram of the components of a creative transaction: the roles described here correspond only to the initial phase: in a complete transaction, the beneficiary self responds by adopting a symmetrical position conducive to joint semiotic production.

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 in particular and therefore make for efficient semiotic production via a given medium and efficient reception of the product transmitted via that medium.

- Lastly, ongoing *semiotic(co-)productions*[3] can be understood as a cycle in which producers communicate *semiotic content* to recipients via a given *medium* thereby providing them with new resources for updating and transforming the transactional situation (the joint project, the social relationships, the participants' skills and their representations, for instance). This cycle is shown in Figure 1.

3.1. COMPONENTS OF SEMIOTIC PRODUCTS

The following diagram is useful in identifying the components of semiotic products (Figure 2):

The *medium* or substrate of a semiotic product can be analysed in terms of:

- The *mode of expression* which is adopted for communicating (spoken or written language, gesture, film, etc.), and which respects a set of arbitrarily defined syntagmatic and paradigmatic conventions
- *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) can also be analysed at two levels:

- Its *evocative power*, which means its ability to trigger *common representations*[4], 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);

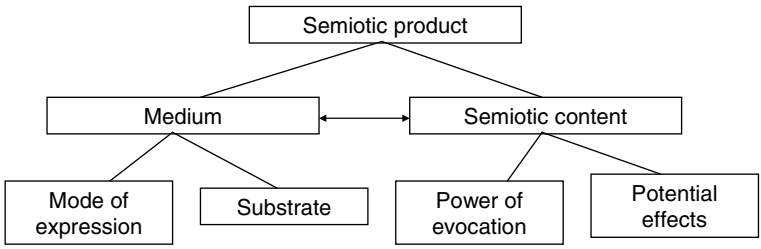

Figure 2. Components of the semiotic product.

- 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 recognised as having furthered the transaction[5] (the *potential effects* are one of the aspects traditionally studied in the field of pragmatic linguistics).

In order to help understand these definitions, we've drawn up the following non-exhaustive list of literary and documentary genres and classed them in a decreasing order of standardization. Accordingly, we expect the evocative and socio-cognitive effects of these different genres to be more readily understandable in the standardised situations at the beginning of the list than in the non standardised situations at the end (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 of the story In all these literary[6] 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, makes use of explicit links based on the thread of discussion structure, and seems to be less completely integrated than a technical document). Finally, it is worth noting that a distinction is made in the above definitions 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.

3.2. DISTRIBUTION OF TRANSACTIONS IN A HETEROGENEOUS SPATIO-SOCIO-TEMPORAL FRAMEWORK

In widely distributed collective activities producers and recipients of communicational transactions are not all in the same spatio-temporal framework. This means that the documents produced must last over time if they are to be used as a support for transactions. Transactions are initiated, interrupted, updated and repeated in configurations involving the presence or absence of producers and recipients. But at the same time, distant producers can sometimes 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 physical or sensory effects rather than effects of a psychic nature (the latter term is intended to cover both the cognitive and affective or emotional effects).

The two main components described above are always present in a transaction. Sometimes, the semiotic effects predominate as in the case of written and spoken language and we speak of a semiotic medium. Sometimes the material aspect dominates[7] and we speak of symbolic objects whose effects are exerted on sensory organs through a *physical substrate*. 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* (Zacklad, 2004). These various means are not mutually exclusive and are often complementary.

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 have transient effects on the recipients' sensory organs, especially due to the fact that the form given to the 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 writers and 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 another 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 producers and 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 for 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 models.[8] 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 effects.[9] 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"[10] (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*, Dourish and Belotti, 1992; Heath and Luff, 1992), or on a partial formalisation of the semiotic product (*Web Semantic* approaches, see Tim Bernes Lee et al., 2001). Our own analysis of the concept of Documents for Action is 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.

4. Processes and means of documentarisation

4.1. TRANSCRIPTIONS AND RECORDINGS

Techno-informational equipment can be used in two ways for documentarisation because *transcription* and *recording* are the two main methods of conveying a semiotic product via a perennial medium. 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 content of 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, a risk exists 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 effi-

cient, 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 look like faithful recordings of reality, are in fact completely artificial constructs using new modes for expressing semiotic contents.

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 utilisation 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 *standardised 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 in such places as *libraries, archives, filing cabinets, administrative, technical and documentary databases of various kinds* (large or small, private or public, han-

dling 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.

The first method of document management means that documents have to be endowed with a number of attributes for semantically articulating them 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.

The second method of document management requires that documents be endowed with attributes making it possible to decompose them into coherent parts (the title, spacing, index, etc.), highlighting certain expressions and thereby guiding readers semantically through their semiotic content (subtitles, 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. In connection with the main transactional project summarised by the heading of a document, transactional sub-projects exist and are materialised by documentary fragments. Their diversity makes it more or less difficult to link them into a coherent whole. The need to provide readers with a means of positioning themselves with respect to the semantic content of 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 when sharing 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 parallels and complements the implicit system just described. It consists of either 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 its objectives until a potentially 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*[11]. 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 production.[12]

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 et 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 authorised 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 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 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, other cooperation technologies exist 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 Figure 3 and Table I).

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 and 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.

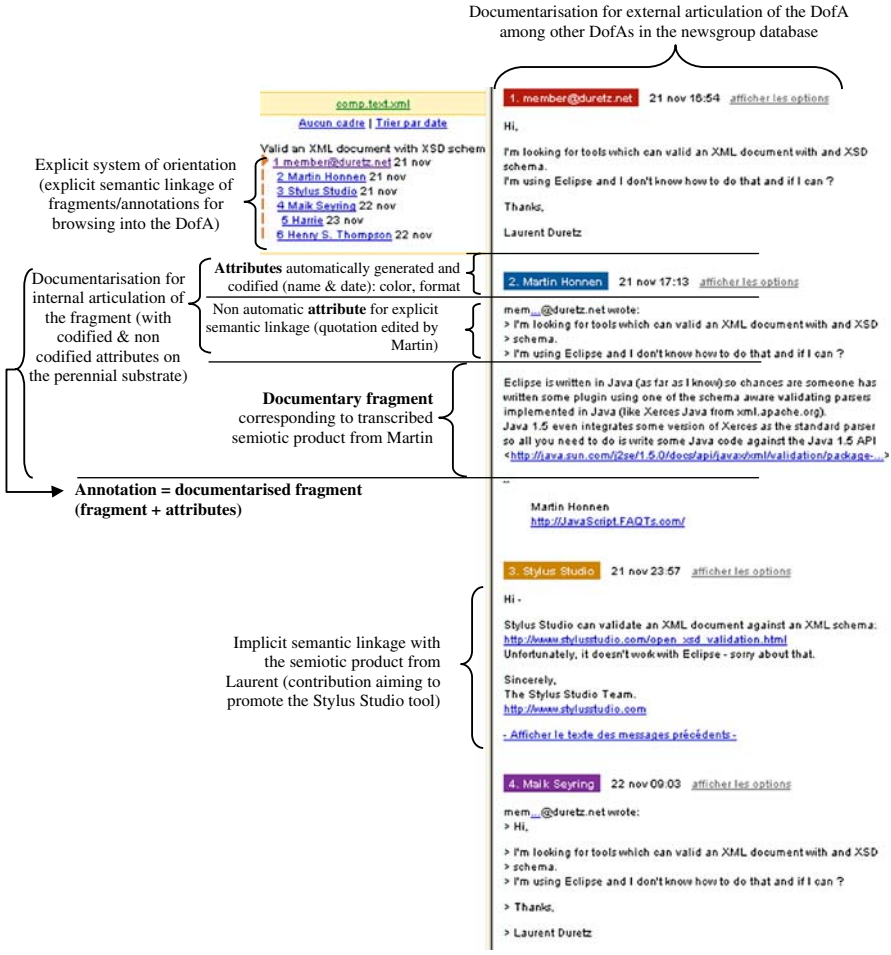

Figure 3. Example of DofA based on newsgroup technology.[14]

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

Kind of micro 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 functionality			
Providing suggestion	Annotation suggesting the use of an other tool			

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 have generated new hypotheses about communicational transactions and the conditions for carrying them out, thanks to (i) the systematic, detailed descriptions of situations for drawing up new use scenarios and (ii) assessments of the use of prototypes designed on the basis of these scenarios.

Lewkowicz and Marcoccia (2004), for example, have suggested a new attribute which can be used for externally articulating the semantic content of a fragment with subjects under discussion in newsgroups. Use of the attribute depends upon whether the recipient of a proposed micro-transaction is the only socially recognised participant or if the whole collective is involved. Its creation suggests new ways in which man/machine interfaces can intervene in newsgroups as well as new ways of displaying on-going micro-transactions. One of the aims of the Médiapro and Médianotte projects (Zacklad et 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 of 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 is complementary to the Semantic Web project in that the latter has focused mainly on defining universal, entirely standardised "formal ontologies" while the former was intended to provide highly flexible codification databases to meet the changing requirements of local communities of users. Instead of formal ontologies, the W2S project favours the use of *semiotic ontologies* (Zacklad, 2005b) in order to establish *interpretative* relationships between semiotic concepts and the situations for which they stand, and the "mutual connotations" conveyed by semiotic concepts within a corpus in a multiple viewpoint setting.[13] The use of DofA, which are intrinsically uncompleted documents expressing the contrasting points of view of various communities of 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.

Notes

1. The extent to which a transaction is active or not does not depend upon when a document is written. The relationship of religious communities to the texts they hold to be sacred clearly shows this.
2. 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 acceptation of the term.
3. When a transaction is highly standardised and its production highly codified, we speak about informational transactions.
4. 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.
5. This corresponds to Clark's "Discourse Record".
6. 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.

7. 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).
8. Here we are referring to the automated coordination mechanisms described by C. Simone and K. Schmidt (1996).
9. 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.
10. As defined by Schmidt and Simone 1996.
11. This definition is not in contradiction with the definition for annotation recently proposed by Bringay et al. (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.
12. 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*.
13. These semiotic ontologies can be handled using standards such as "HyperTopic" implemented in the Agorae platform (see for example Cahier and Zacklad, 2002; Cahier et al., 2004). This is a tool designed for the evolutive management of semiotic ontologies by various communities of users.
14. http://groups.google.com/group/comp.text.xml/browse_frm/thread/b0c140627f3b474d/42196d8c72bb8fa1?tvc=1#42196d8c72bb8fa1 See also (Sack et al., 2006) in this volume about the importance of quotations in newsgroups.

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