On Structured Manuals Analysis and Design for Japanese Enterprises

Yoichi Masuzawa

Japan Productivity Center for Socio-Economic Development, ymasuzawa@acm.org

Follow this and additional works at: http://aisel.aisnet.org/amcis2000

Recommended Citation
http://aisel.aisnet.org/amcis2000/296

This material is brought to you by the Americas Conference on Information Systems (AMCIS) at AIS Electronic Library (AISeL). It has been accepted for inclusion in AMCIS 2000 Proceedings by an authorized administrator of AIS Electronic Library (AISeL). For more information, please contact elibrary@aisnet.org.
On Structured Manuals Analysis and Design for Japanese Enterprises

Yoichi Masuzawa, Japan Productivity Center for Socio-Economic Development, ymasuzawa@acm.org

Abstract

This paper tries to establish an analysis and design method for internationally intelligible Japanese business manuals compilation, using a theory of transformation between a natural language and a systems language which consists of DFDs (Data Flow Diagrams), ERDs (Entity Relationship Diagrams) and Mini-specs.

In Japanese enterprises nowadays, business manuals are virtually a kind of policy statement or a list of “kitei”, or regulations which do not specify detailed business procedures. On the other hand, a typical American business manual defines step-by-step business processes in greater detail. Moreover, unlike American companies, Japanese enterprises are not utilizing business manuals for the purpose of analyzing and design of computer systems and software.

Recently, however, because of the now de facto global standards in terms of quality control (ISO9000s), environment protection (ISO14000s) and accounting procedures (IAS) or ERP (Enterprise Resource Planning) computer application package which contains some parts of these standards, Japanese enterprises have come to realize the importance of incorporating American style business manuals.

With this background in mind, this paper firstly defines the major characteristics essential for an “ideal” business manual that on the one hand takes into consideration current global business standards and on the other hand is compatible with the notion of systems analysis or design. Also, optimal business manual written in a natural language should be able to be transformed automatically into systems language expressed in DFDs and ERDs and Mini-specs. Finally this paper tries to establish a transformation theory called Structured Manuals Analysis and Design Theory.

First of all, in researching preceding works related to systems language, this paper found that the current systems languages are designed to easily be translated directly from natural language (English) with only several basic transformation rules.

Secondly, this paper found that the structure of a typical American business manual is closely related and coherent to the structure of a systems language, i.e. the policy part corresponding to ERD, the procedure part to the DFD and the process part to the Mini-spec.

Thirdly, to apply the transformation rules to manuals written in the Japanese language, this paper utilizes such linguistic concepts as “surface structure” and “deep structure” (N.Chomsky) with “structured inter-language” which will be defined precisely later in this paper. To convert a natural language into the systems language, the structured inter-language supported by “Deep Case Theory” (C.Fillmore) plays the most important role in terms of verifying the semantic equivalence between natural and systems languages.

Finally this conversion theory is computerized into a software package named SMAD (Structured Manuals Analysis and Design). The SMAD has already been successfully applied to Japanese enterprises’ business procedures and proven to be valid.

The transformation theory also covers reverse transformation, i.e. from the systems language into a natural language – in our case, English or Japanese.

Although there are some points to be improved, the transformation theory will contribute to Japanese enterprises that are about to be globalized by letting them utilize an effective business procedure manual.

Chapter 1: Business Manuals

In chapter 1, the author discusses the definition of manuals. The main question asked here is “Are business manuals universal?”

A Japanese company tried to implement the ERP (Enterprise Resource Planning) application package only to find that it was impossible. The analysis and design process of the implementation failed because of the lack of information about business procedures. A typical American company prepares its business procedure manuals before doing a systems analysis. A business manual in America, therefore, refers to a document, which describes business procedures in detail (Optner 1975, Kendall & Kendall 1995, Senn 1993). Contrary to its American counterpart, a Japanese company seldom prepares business manuals thanks to the famous Japanese tradition of tacit knowledge. Detailed procedural
knowledge is expected to remain non-verbal or tacit knowledge about which no manuals are needed.

The premise of this paper is that Japanese companies need to maintain structured manuals. The problem in implementing the software package is not the only reason why Japanese companies should prepare business manuals. International requirements with regard to quality control (ISO9000s), environment protection (ISO14000s), labor relations (ISO16000s), and accounting procedures (IAS) make business manuals all the more indispensable. Structured manuals are undoubtedly becoming an integral part of global business systems.

American manuals are typically standardized, systematized, and simplified. Their historical development is found in scientific theories of management (Taylor 1911) and military instructions. A multicultural society requires detailed instructions for mutual understanding to avoid mistakes, especially in business fields. Highly structured American manuals are also useful for Business Process Reengineering (BPR) and systems analysis and development. The structured business manuals can be divided into several parts according to ANSI based ISO9000s statements. These are: purpose, responsibility, related instructions, procedures, verification and records. These six constituent parts can be summarized into two major divisions: “policies” and “procedures”.

In Japan, traditional business custom based on tacit knowledge has been producing unique business manuals which are not detailed in terms of describing procedures step by step. Although an exception is made for Total Quality Control where detailed manuals are prepared for the production line, no such manuals can be expected for office work. Therefore, for systems purposes, Japanese manuals are not utilized. Moreover, not only systems analysis and development, but also other fields such as accounting, quality control, and other business operations require more detailed manuals than are currently provided by Japanese companies.

The ideal business manual, therefore, should be defined by the following characteristics. First, it should be easily convertible into a systems language (i.e. ERDs, DFDs and Mini-specs). These are mainly used for defining requirements made by users of the systems.). Second, it should fulfill the requirements of ISO9000s in terms of scope, definition and organization of the manuals. And third, it should be utilized effectively for Business Process Reengineering. This paper mainly focuses on the first characteristic stated above. By analyzing preceding research it is assumed that the manuals written in the natural language (English) can be converted into a systems language expressed in DFDs, ERDs and Mini-specs. This assumption will be discussed more in the next chapter. In chapter 3, this paper tries to formulate a method for converting the Japanese language into a systems language and vice versa.

Chapter 2: Genealogical Analysis of a Systems Language.
In chapter 2, the paper discusses some of the major terms which are defined as follows:

- **ERD**

ERDs (Entity Relationship Diagrams) and its parts, i.e. entities, relationships and attributes, are based on Western traditional concepts from Aristotles (Jaeger 1957) *Metaphysics* to the AI (Artificial Intelligence) theories such as the semantic network by M.Quillian (1967, 1969). Predicate logic and double-entry bookkeeping as well are derived from the same concepts of entities and relationships. The inventor of ERDs, P.Chen, designed the ERD chart to be easily and directly translated from the natural language, i.e. English (Chen 1983, 1985). In relation to business manuals, the policy part corresponds to ERD descriptions. Grammatically, stative verbs such as “be” (corresponds to “is-a” relation in semantic network notation) or “have” (“has-a”) are ERD related verbs.

- **DFD**

DFDs (Data Flow Diagrams) are diagrams which show data flow using data elements such as origin (from), destination (to), input, output and processor (by whom). In C.Fillmore’s *Case Theory*, these elements are defined as *Case Frames* and its system is universally applied to any language going beyond the clause level (Fillmore 1971). As the inventor D.Ross states, natural language sentences can be mapped into DFDs automatically and quite logically. D.Ross, moreover, compares DFDs to *Universal (International) Language* (Ross 1977). In relation to business manuals, the procedure part corresponds to DFDs descriptions. Grammatically, non-stative verbs such as transitive verbs are DFD related.

- **Mini-spec**

Mini-specs, which is simplified English like *Basic English* by Ogden & Richards, are also related to the natural, English language structure according to the inventors’ ideas. T.DeMarco, the advocate of the simplified language, refers to R.Flesch’s famous university textbook “Plain English” as a useful guidebook for compiling “Mini-specs” in terms of its grammar, sentence structure and vocabulary (DeMarco 1979) (Flesch 1946) (Caine & Gordon 1975). As far as business manuals are concerned, the process describing part corresponds to mini-specs descriptions.
All these triad relationships, between and among business manuals, grammatical elements in a natural language and the main component of the systems language can be summarized as follows:

<table>
<thead>
<tr>
<th>Business Manuals</th>
<th>Grammatical Elements in a Natural Language</th>
<th>Systems Language</th>
</tr>
</thead>
<tbody>
<tr>
<td>Policies</td>
<td>Stative Verbs</td>
<td>ERD</td>
</tr>
<tr>
<td>Procedures</td>
<td>Case Frame (Fillmore)</td>
<td>DFD</td>
</tr>
<tr>
<td>Processes</td>
<td>Sequential, Conditional and Repetitive Verbs</td>
<td>Mini-spec</td>
</tr>
</tbody>
</table>

Fig. 1 Triad relationship among Manuals, Grammar and Systems Language

Chapter 3: Natural-Systems Languages conversion technology.

This chapter tries to establish a conversion theory from a natural language to a systems language utilizing C.Filmore’s *Case Theory*. A well-known conversion process is the process of conversion in general machine translation, which is divided into three processes: analysis, transformation, and generation. This process can be applied to a Natural-Systems languages conversion process such as analysis process, structured inter-language process and systems language generation process.

To carry out the above steps, basic technologies have been invented. These are: structured inter-language, modified *Case Theory*, and *authentification*. Before explaining these technologies, this paper will briefly discuss some of the basic ideas including the following:

*Surface structure* (Chomsky 1965) refers to the sentence which is actually used. This paper defines it as a sentence with some redundant elements which can be deleted. *Deep structure* (Chomsky 1965) refers to the underlying well-formed sentences. In this paper, it is defined as a sentence with sufficient elements in order to write a systems language.

*Transformation* and *generation* are defined as the structuring and refining of actual sentences in order to acquire their deep structures and write them in the form of an inter-language called structured inter-language which contains sufficient elements for full semantic interpretation. Afterwards, the deep structure stated in the inter-language is converted again into the surface structure in reverse in terms of the systems language.

The basic theory of analysis and conversion utilizing the structured inter-language is the modified *Case Theory* based on C.Fillmore’s *Case Theory*. The modified *Case Theory* especially focuses on Japanese sentence structures and “joshi (particles attached to nouns)” which indicate clearly each case relationships between constituent arguments. As it is effectively applied to the Japanese natural language, this paper uses the Fillmore’s original theory extensively. See Figure 2.

Another important technology is that of *authentification* in which either redundant elements are deleted or missing links recovered in the surface structure. Linguistic theories such as C.Halliday’s are used to deal particularly with the problems of *cohesion* and *deletion* at the sentential and textual level (Halliday & Hasan 1976).

Finally the entire theory is put together in the form of a computer software package named SMAD (Structured Manuals Analysis and Design). The software package was successfully applied to Japanese enterprises’ business procedures in terms of business manuals analysis and design.
In addition to the analysis and generation process from natural language to systems language, this paper also discusses the reverse process. And every natural language manual which is regenerated from a systems language is highly structured. The author calls the entire process manuals’ life cycle. See Fig. 3.

The manuals’ life cycle is especially applied for confirming multicultural business procedures. Exchanging business procedures written in structured inter-languages both English and Japanese (deep structure) must be much more effective and precise than exchanging directly between the original natural language manuals (surface structure). See Fig. 4 and a sample result of SMAD algorithm which includes original Japanese sentences, Structured inter-language in Japanese, Structured inter-language in English, DFD in English and English sentences.

Sample Result of SMAD and some points to be improved

Here is an example of SMAD sentence generation. About this example, the original natural language sentences are written in Japanese (Sample 1). Structured inter-language in Japanese (Sample 2) then converted into English inter-language (Sample 3). English inter-language produces systems language (Data Flow Diagram: Sample 4) and the natural English sentences (Sample 5).


**Sample 2** Structured inter-language in Japanese

1-0. : [tokuisaki] chumon (juchu memo-wo sakuseisuru juchu jimugakari) juchu memo

1-1. : [tokuisaki] chumon (kaitousuru juchu jimugakari) juchu kahi

1-2. : [shinagire shinausu joho] shinagire shinausu memo (kaitousuru juchu jimugakari) juchu kahi [tokuisaki]

1-3. : [shohin kanrigakari] shinagire shinausu memo (irekaesuru juchu jimugakari) shinagire shinausu memo [shinagire shinausu joho]

1-4. : [tokuisakidaicho] tokiusaki joho (uriagedenpyo -wo sakuseisuuru juchugakari) uriagedenpyo [shukkagakari]

1-5. : [shohindaicho] shohin joho (uriagedenpyo -wo sakuseisuuru juchugakari) uriagedenpyo [shukkagakari]

1-6. : [order acceptance memo file] order acceptance memo (prepares sales voucher|ordering clerk) sales voucher [shipping clerk]

1-7. : [order acceptance memo file] order acceptance memo (preserves|ordering clerk) sales voucher [sales voucher stub file]

**Sample 4** DFD generated by Structured inter-language

**Sample 3** Structured inter-language in English

1._0. : [customer]-order-(prepares order acceptance memo|ordering dept.)-order acceptance memo-[order acceptance memo file]

1._1. : [customer]-order-(replies|ordering dept.)-order acceptance decision-[customer]

1._2. : [want information]-want slip-(replies|ordering dept.)-order acceptance decision-[customer] (want information: shortage information, want slip: notice of shortage)

1._3. : [commodity control clerk] -want slip-(changes|ordering dept.) -want slip-[want information]

1._4. : [customer ledger]-customer information-(prepares sales voucher|ordering clerk) -sales voucher-[shipping clerk]

**Sample 5** Sentences generated by Structured inter-language

1._0. Customer sends order to ordering dept., which prepares order acceptance memo to order acceptance memo file.
1_1. Customer sends order to ordering dept., which replies concerning order acceptance decision to customer.

1_2. Want information provides want slip for ordering dept., which replies concerning order acceptance decision to customer.

1_3. Commodity control clerk sends want slip to ordering dept., which changes want slip for want information.

1_4. Customer ledger provides customer information for ordering clerk, who prepares sales voucher for shipping clerk.

1_5. Commodity ledger provides commodity information for ordering clerk, who prepares sales voucher for shipping clerk.

1_6. Order acceptance memo file provides order acceptance memo for ordering clerk, who prepares sales voucher for shipping clerk.

1_7. Order acceptance memo file provides order acceptance memo for ordering clerk, who preserves sales voucher for sales voucher stub file.

Since the modified Case Theory and SMAD are mainly invented for Japanese language, it is difficult to apply to English language without artificial clumsiness in terms of sentences generated by the algorithm. The artificial clumsiness should be smoothened by utilizing case grammar or other grammatical and mechanical translation theories more effectively.

**Conclusion and some additions**

In conclusion, this paper successfully established a conversion theory between a natural language and a systems language and vice versa. The viability of the theory has also been confirmed in the form of a computer software package as it has been tested and verified in the actual business world.

Major contribution of the current work is to invent structured inter-language in order to convert a natural language into a systems language. This notion of structured inter-language is supported by C.Fillmore’s *Case Theory*. Other topics that deserve a special attention here are:
- Since current theory requires an inter-disciplinary approach within information science from systems engineering to machine translation, this theory can be applied to other academic fields such as translation, interpretation, and linguistics (Gile 1995) (Littleton 1933).
- This theory can also be applied to business fields other than business manuals, such as knowledge management (Nonaka 1990).
- This theory defines which types of sentences are optimal for business writing in terms of systems requirements definition.

Finally, *Object oriented technologies* can also be considered in the future for further refinement of the current theory.

**Acknowledgments**

As a business person who has worked at both American and Japanese companies, Mr. James Bauernschmidt, CPA, contributed suggestions and corrections from Western and multi-cultural business perspectives.

I am also grateful to Professors Takuro Munezawa (Niigata University of International and Information Studies) and Hiroyuki Matsutani (Tama University) for their helpful comments.

**References**


Chen, P. (1985)

Chomsky, N. (1965)
DeMarco, T. (1979)
*Structured Analysis and System Specification*
Prentice-Hall Inc. Tokyo.

Fillmore, C. (1966)
“Toward a modern theory of case” *POLA (Project on Linguistic Analysis, Columbus, Ohio University.*) 13, pp.1-24; D.Reibel and S.Schane (eds.), *Modern Studies in English.*

Fillmore, C. (1967)
“The grammar of hitting and breaking” *WPL (Working Papers in Linguistics, Columbus, Ohio University) 1*, pp.9-29; R.Jacobs and P.Rosenbaum (eds.), *Readings in English Transformational Grammar.*

Fillmore, C. (1968a)
“The case for case” *Universalis in Linguistic Theory.*

Fillmore, C. (1968b)
“Lexical entries for verbs” *WPL 2*, pp.1-29.

Fillmore, C. (1968c)
“Types of lexical information” *WPL 2*, pp.65-103.

Fillmore, C. (1971)
“Some problems for case grammar” *WPL 10*, pp.245-265.

Flesch, R. (1946)
*How to Write, Speak, and Think more Effectively* Signet.

Gane, C. and Sarson, T. (1979)
*Structured Systems Analysis: tools and techniques* Improved System Technologies, Inc., NY.


Littleton, A. (1933)
*Accounting Revolution to 1900.* New York.

Nonaka, I. (1990)

Optner, S. (1975)
*Systems Analysis for Business Management*, Prentice-Hall.

Quillian, M. (1967)

Ross, D. (1977)

Senn, J. (1993)

Taylor, F. (1911)
*Scientific Management* (Japanese Translation in 1984).