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UNDERSTANDING TEXT MESSAGES IN HUMAN–COMPUTER INTERACTION

Summary

The paper presents a proposal to take into account the language comprehension paradigm in an attempt to improve the design methodology of human–computer dialogues. It is assumed that the user treats a system as a subject, i.e. perceives communication with the system as a kind of discourse and intuitively treats it as cognition of the world through a fixed image of objective linguistic signs. Due to the fact that every end-user of a computer system has an individual linguistic competence, thesaurus, habits, previous experiences, one can never guarantee that identical semantic references arise in a variety of audiences.

Keywords: human-computer interaction, phenomenon of understanding, language comprehension paradigm, quality of a dialogue

Introduction

The phenomenon of understanding, examined as a whole by researchers representing psychology, didactics and sociology in the context of solving communication problems, teaching and professional performance, should also be taken into account by computer engineers – designers of information systems and designers of users' interfaces. This need has become urgent recently as there is a users' growing demand for fast, conscious and efficient use of greater amount of outer knowledge, present in different forms, from books to websites.

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1. Understanding textual communiqués in the context of information system

Yet in 70s it was established (Pennington 1987), that to be able to work efficiently with a new system or code, a programmer must understand five levels of abstraction: function, data flow, steering flow, operation, and state. The research in question defines understanding and mastering all five abstractions. Since the model works for any given type of software, it does not refer exclusively to the specificity of a programmer's mind. It focuses more on the functionality of software, therefore the model may relate to almost any computer user. Lack of awareness of this standard, in the context of the assessment of the abstraction, may bring numerous cognitive inaccuracies while explaining complex ideas.

In the context of a user's interaction with a new interface of an information system, understanding has a practical meaning, most importantly as an acceptable result of semantic perception of linguistic content. In this sense, objects of understanding are system events and communiqués written by the system (messages, information, announcements, reports, applications, forms).

At the level of abstraction relating to linguistic signs one may claim that an individual understands an expression (a statement, a view), when he/she perceives them correctly, which means that he/she knows the sense of this expression. The term „sense” in the definition of understanding a linguistic sign is used here in the strict meaning, as an indicator of fulfilling certain pragmatic or semantic functions by a certain expression. The users of expressions, forming a dialogue carried by with an information system (IS) are in fact designers (authors of communiqués) and end users (addressees of the communiqués) of a system. An IS user, as an addressee of a certain expression understands it when he/she knows its semantic and pragmatic functions.

When users of a given linguistic expression understand it, one may say that there occurs a pragmatic relation between the sender and addressee of the expression as a result of understanding of the expression in question. In this situation it is a pragmatic relation between a designer and the target IS user. The success of introducing an information system may be based on the occurrence of such relations, characteristic for a problem domain and a specific IT project. One of significant obstacles in achieving this success is the already mentioned ambiguity of the semantics of a text, which comes into being as a result of the realization of individual strategies of understanding. It has to be accepted that

independently from the text there are its different mental images in an author's and the reader's mind, not necessarily identical with the text. This phenomenon is known in philosophy and allows to take into account the most general associations and rules characteristic for governing all phenomena in the world and in thinking. In cognitive science, on the basis of this phenomenon, there is a predictable generation of conceptual systems and operating with types of knowledge. In psycholinguistics the same applies to a text and oral and thinking specificity of an individual. From computing point of view, it can be said that there is an individual and independent mapping of information about the object of understanding. In this sense, a text, as an object of understanding, objectively has the feature of being prone to interpretation, the interpretability feature of a text conveying objective content, is being the basis for further subjective interpretation.

In practice there is always a diversity of the interpretation of a text by readers, which is an manifestation of the already mentioned semantic ambiguity (Кирсанова 2007). A repeated set of reactions was noticed in the research concerning the diversity of interpretations, characteristic for a given individual and showing a stable strategy of understanding a text by a given addressee. There have been discovered two main ways of building sense of a text read by a reader – a generalization with ignoring some details and separating a dominating sense component on the way to rebuilding the hierarchy of elements of the contents. This confirms once again that the direct result of the phenomenon of understanding is the acknowledged sense of a communiqué, not the subject matter or contents.

It is worth drawing attention to the possibility of organizing for the IS user a dialogue in the environment of rational perception. It is to be a constructive process in the sense that it is to formalize the deepest and hidden side of the phenomenon of understanding according to the rules of visual methods – in a form of a construct. This construct, in opposite to a natural language is a formal language, specific for a problem domain. In a dialogue with the user both languages are present, which means that the designer should understand both of these bonded languages (Малиновская 1974) in order to work out a correct dialogue.

An engineer approach to designing dialogues with the user is to be based on the logical analysis of the content of the communiqués. There is a need to broaden the tool set of this analysis with another term – a proposition (Latin: *propositio*). A proposition in the logical sense is the meaning of a sentence in the logical

sense. The proposition is a semantic invariant for all members of modal and communication paradigm and derivatives from the specific sentence structure. The propositions are equipped with a feature of being true or false, similarly to sentences. A given subject is a proposition, if it has the following characteristic features: independence from a language – different linguistic expressions may represent one proposition, and having a stable logical value, independent of the pragmatic context – the circumstances of delivering of a specific statement influence the proposition expressed by the statement but it does not influence the logical value of the proposition itself.

An engineer approach to the matter of a dialogue with the IS user should take into account the structure of a text as well. Noam Chomsky distinguished two perspectives of the examination of a linguistic text structure (Chomsky 1968): deep structure which is the meaningful content (conveying the meaning) of a particular text and a surface structure which stands for the form of the text (words, phrases, inflectional forms and syntax constructions used in the text). The relation between these structures is called linguistic style. In practice the analysis should cover not only the hierarchical structure of a dialogue but also causative and logical structure of the text forming a dialogue.

2. Problem of gradation of understanding

It is known (Ajdukiewicz 1975; Наролина 1982), that understanding of a linguistic expression is gradable. One may say about a degree, a level or about the depth of understanding of a specific expression. It is said that the bigger the user's awareness of semiotic functions of a specific linguistic sign the better the degree of understanding of it. In other words the user's understanding of a certain statement increases together with the amount of his/her knowledge and associations it provokes. As a result, the better a user's understanding of a statement, the more he/she is able to know (associate) its consequences. The user understands a given name better, the more he/she is able to be conscious of other names in which it is contained and with which it is associated.

One may single out, in this sense, a subjective criterion of understanding linguistic expressions as a feeling that a certain expression is understood. Then the objective criterion of understanding is the ability to introduce changes to the expression. Although the subjective criterion of understanding is not available to outer observation, it is worth considering it as a necessary, although not sufficient

condition, to achieve full understanding. In this sense, successful acceptance tests (IS tests with representatives of the end user) may be treated as a necessary condition of a well designed dialogue. While the objective criteria may provide digital indicators of the quality of a dialogue. Unfortunately, it would be naive to expect the possibility of this kind of measurements within the frame of typical processes of software production. Such measurements should be carried out as additional research going beyond the assumed production process.

Understanding, in the professional activity of designers and users of the information systems, cannot be described as a simple two-phase phenomenon characterized by going from the state of “not understanding” into the state of “understanding”. Understanding is to be regarded as a cyclical process consisting of an analysis and synthesis, containing the distinction of semantic „milestones” and a combination of all of them into the holistic thinking process, directed to solving individual’s tasks (Наролина 1982). Understanding at the entry level is an analysis, but at the very moment of the beginning of understanding it is always a synthesis, combining parts into a whole. Keeping that in mind, understanding may be interpreted not only as a process, but also as a result of cognitive processes.

During communication in the relation human-computer understanding linguistic expressions is generally not expected because of numerous reasons. Lowering the level of the complexity of communiqués, which is making them more legible is definitely an efficient strategy increasing the degree of understanding. This strategy may be carried out at the stage of designing dialogues with the user. An advantage of users’ professional interfaces is to be succinct vocabulary, lack of idiomatic expressions and avoiding sentences of complex, ambiguous or unorthodox structure.

The depth of understanding may be characterized by specifying degrees or levels of understanding, as well as by differentiating the stages of the process of understanding. With the first approach, the depth of understanding may be depicted by the level of the concepts which are reached by the IS designer. At the entry level one may differentiate in the subject only a certain accidental feature or functionality, which is planned to be put into practice by the designer. But further on the designer progresses to higher levels of understanding, exploring such aspects of the subject matter as:

- relating the currently learned feature or function to a general, well-known category,

- differentiating the specificity of the currently learned feature (function) in an analytical process,
- progressing from the holistic reception to detection, analysis and synthesis of the (integral) parts of a system, events (in the system sense), process, object,
- establishing (with the help of induction and deduction) cause-effect relations and logical relations between analyzed objects and actors (the users of the system).

The depth of understanding is not depleted by the difference in the levels of understanding. ‘Clarity’ may be introduced as the second important dimension of understanding. It is to convey the dynamics of understanding at each level. This dynamics may be divided into stages:

- introductory understanding – at the level of slogans,
- vague understanding – feeling, not cohesive,
- subjective understanding – achieved, but not yet verbally expressed,
- active understanding – understanding which can be conveyed to another person in an oral or written form.

3. Dialogue with an information system as a discourse

In the circumstances of communication between the user and IS, a text of a dialogue reflects the reality in an indirect way, because it is the world of virtual images, recorded via linguistic signs. Every addressee has an individual linguistic competence, thesaurus, habits and practice. As a result, there is no guarantee that each addressees will have identical semantic references and referential environment. If a dialogue is led between a user and a system, one may picture this as a written variation of a discourse, then one may attempt to transfer onto it the main regularities detected during the examination of the phenomenon of understanding cohesive texts. The process of understanding may be regarded as a specific interpretation which is creating one’s own inner text in something analogical, but not identical with the original both in form and in content.

Modeling a strategy of processing a cohesive text (Van Dijk, Kintsch 1983) has gone through a long way from understanding specific words, through understanding single clauses and to understanding the highest structures of a text. It turned out that e.g. understanding a function of a word in a statement depends on the function structure of a sentence as a whole, encompassing the syntactic and

semantic levels. In this way between complex and simple units of a cohesive text there is a positive feedback. An objective verification of the level of understanding of a text occurs on the way of an analysis generated by the addressee of new texts on the basis of acquired texts. Unfortunately, in case of designing dialogues for IS, receiving the process of understanding as an addressee's ability to generate new texts on the basis of the already acquired ones, does not give enough indications as to the design(ing) decisions, concerning the dialogue with a user. After all, the content "uttered" by the user in this dialogue is static, imposed by the designer like the context of its utterance. The specificity of a dialogue in computer applications is that a user is limited to statements of the following type: "Yes, print a report" or "Change the type of work into..." or "I accept the setting of parameters", which means he/she should choose a ready-made answer or one of available defined actions.

The interpretation of the understanding of a dialogue as a subjective perception of sense and meaning of deciphered communiqués may turn out to be more efficient. Then the main result of the dialogue becomes the user's state of awareness, occurring thanks to this dialogue. This state is recorded by the user (subject) as certainty of consonance of recreated ideas. In theory two different mechanisms of such understanding are expected: shaping concepts or immediate creating structures – insight.

Shaping a concept is a complex process as a result of which the concept gains sense, a specific meaning in an individual's consciousness. On one hand a concept, because of its generality, is in modern culture the optimal means with which people understand one another. On the other hand, the generalization contained in a concept creates a wide range of variations of images appearing during attempts of understanding. In this sense concepts do not necessarily have to be understood unambiguously.

Understanding a cohesive text is defined by Chun and Plass (1997) as a process of structurization of mental representations of textual information. According to the author of this publication, first the structure of a text is analyzed at a linguistic level and then representations of statements of semantic structure of the text are created. Finally, the reader constructs a mental model of an object using a diagram.

Within the frame of a model of understanding Mayer's text, Chun and Plass (1997) are able to analyze the usefulness of multimedia information in relation to advanced cognitive processes. According to Mayer (1984), there is sense in three

categories of supporting the process of understanding a text, presented in form of conceptual diagram in Figure 1:

- helping in the choice of information, which is to concentrate the reader’s attention on certain aspects of target information,
- helping in building inner coherence,
- helping in building outer coherence.

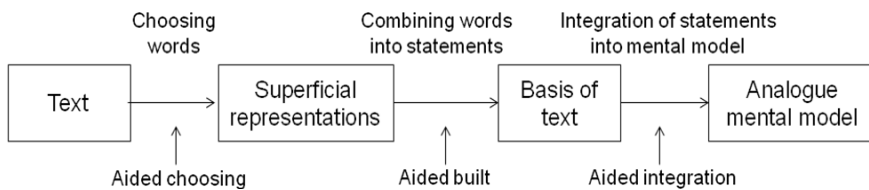


Figure 1. Conceptual model of the process of understanding a text on the basis of article
Source: Mayer (1984).

A situation should be mentioned separately when the users have to take advantage of an information system which is not fully localized. While reading a communiqué in a foreign language there emerges an additional problematic situation of logic-semantic gap in the information chain of the communiqué. This situation occurs as a result of a contradiction between the author’s text and its reception by the person reading it.

As far as understanding foreign texts is concerned within the frame of a dialogue with IS it may be stated that the necessity of translation of communiqués definitely hinders understanding. At the first stage of the perception of not localized interface there is the mere establishment of the meaning of words suitable for the context of a specific system and also becoming aware of the syntactic structure. There is a possibility to differentiate a wider period of “entering the system”, due to which there is an anticipation of the content based on the practice and knowledge already possessed by the user. Further on there comes the specification and differentiation of the meaning of the words. Establishing a new contextual meaning of words is achieved while joining words into phrases on the base of “semantic milestones”. During this time the attempt to understand difficult words through deducing hypothesis and guessing is crucial. It leads to the appearance of logical sequences of thoughts, beside which the anticipation becomes correct or without major mistakes. It is the stage of “vague” understanding in the

classification of clarity of understanding. At the stage of direct understanding of communiqués in the consciousness of the addressee all meanings of a word are joined together into a coherent meaning. The reception and thinking are united and inseparable. It is a subjective thinking identified as an achieved understanding but not expressed verbally.

Conclusions

Roland Barthes introduced a unique category readerly text (fr. *texte lisible*, ang. *readerly*). In his opinion a readerly text – a text which can be read, is the one in which the reader does not need to create his/her own meanings which could disturb the perception or introduce contradiction. Barthes (1975) compares readerly texts to cupboards in which meanings are put, sorted and saved. The addressee of a readerly text is passive to a great extent and his/her active effort is not required. A readerly text is fully complete at the moment when it reaches the target user. The work of the integration of all the necessary fragments has been done by the designer of a dialogue, and the user may peacefully work on his/her tasks.

In light of Barthes's model it seems that the texts of the dialogues with the IS user should be built as readerly texts. In this sense they should not introduce new terminology for the target user. They should be narrowed to the professional vocabulary. So they should be as little informative as possible, not teaching the user but rather reminding him/her the already known actions possible for the given context and indicating familiar entities and processes. They may give professional clues, not allowing for a teaching style. The semantic side is to be known and unambiguous. It is achievable by creating and consistent use of domain lexicon, in which each word (linguistic sign) is to be checked from the perspective of semantics and pragmatics. The use of words outside of design lexicon is to be not recommended and may be easily controlled by automatic procedures in a design environment.

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ROZUMIENIE KOMUNIKATÓW TEKSTOWYCH W UKŁADZIE CZŁOWIEK–KOMPUTER

Streszczenie

W artykule przedstawiono pomysł uwzględnienia paradygmatu rozumienia podczas projektowania dialogów dla systemu człowiek–komputer. Autor wychodzi z założenia, że użytkownik traktuje system oprogramowania „podmiotowo”, czyli odbiera komunikację z komputerem jako rodzaj dyskursu i intuicyjnie traktuje ją jako poznawanie świata idealnych obrazów utrwalonych za pośrednictwem obiektywnych znaków językowych. Wzięcie pod uwagę psychologicznego aspektu komunikacji i indywidualnych kompetencji użytkownika powoduje brak gwarancji identycznych powiązań znaczeniowych u użytkownika.

Słowa kluczowe: interakcja w układzie człowiek–komputer, paradygmat rozumienia, jakość dialogów z użytkownikiem