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WHAT COULD OOA&D BENEFIT FROM GROUNDED THEORY?

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1. INTRODUCTION

Doing research or developing information systems development (ISD) often means to use approaches or methods of different kind. Using methods means to use recommendations or guidelines for how something should be performed (see section 3). There exist a lot of different methods, both as support for the ISD process and as support for the research process. The research methods are often roughly divided into quantitative and qualitative methods (e.g. Patton, 1990; Walsham, 1993). In this paper we are interested in qualitative research methods (QRM). Examples of qualitative research approaches/methods are grounded theory (GT) (Glaser & Strauss, 1967; Glaser, 1992; Strauss & Corbin, 1998) and phenomenology (e.g. Heidegger, 1975; Alvesson & Sköldberg, 2000).

The ISD methods (ISDM) support different phases of the ISD process (such as business analysis, design, coding, testing etc). Examples of ISDMs are Rational Unified Process (e.g. Kruchten, 1999), Object-Oriented Analysis & Design (OOA&D) (Mathiassen et al., 2000). Our general research idea is to investigate how ISDMs can benefit from perspectives and guidelines used in research methods. In this paper, we have analysed OOA&D (Mathiassen et al., 2000) as a representative of ISDMs and GT (Strauss & Corbin, 1998) as a representative of research methods. The basic assumption is that both the research and systems development process are knowledge acquisition processes where methods are used which guide the work of acquiring knowledge.

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As researchers, teachers and system developers we have experiences from using both OOA&D and GT. The reason for performing this analysis is that we have discovered that there are both similarities and dissimilarities between the OOA&D and GT. For example, a dissimilarity between OOA&D and GT is that GT is more focused on describing people and their actions compared to OOA&D. OOA&D is also used to study people and their actions however the focus is how IS are used to support people with information. Another difference between OOA&D and GT is that OOA&D has a design purpose. This design purpose could mean that a change of people's behaviour is desired in order to improve human actions with support from IT-systems. The reason for these differences is that GT is not developed in the area of ISD. GT originates from the subject of sociology where studies of peoples behaviour is focused. OOA&D is created in the field of computer science/information science. These preliminary and unarticulated experiences from using both OOA&D and GT are the reason why we in a systematic way will explore and identify strengths and weaknesses in order to understand how OOA&D can benefit from GT. From these experiences, it seems that OOA&D and GT in different ways can complement each other. The aim of this paper is to identify possibilities for incorporating strengths from GT into OOA&D.

One important question to ask is if it is possible or fruitful to compare research methods with ISDMs. According to our opinion is the answer to this question yes. On a basic level both research methods and ISDMs are support for asking good questions and presenting good answers in order to acquire knowledge. Doing research means to ask and answer a research question. To perform systems development means that we ask questions in order to understand a business context and our answer is a suggestion for how an IT-system could support the business.

The paper is structured as follows. After this introductory section we describe the research method used (see section 2). Then, we present the criteria generated for analysing the methods (see section 3). In section 4 and 5 we present the findings. Section 6 consists of a comparison between the OOA&D and GT in terms of strengths and weaknesses. Finally, in section 7 we present our conclusions.

2. RESEARCH METHOD

In order to understand how OOA&D could benefit from GT we have performed a comparison based on a set of criteria. Inspiration for creating the criteria is obtained from the four-tired framework for classification of information systems development methodologies (Iivari et al., 2001), and a question tool (Strauss & Corbin, 1998) The general criteria used are goal (what is the goal of the method, what kind of knowledge should be generated), perspective (type of perspective, articulated or not), concepts (well-defined, clear conceptual structure), why (are recommended actions motivated), structure (detailed rules and

directions, degree of flexibility, systematic). We have also used specific criteria for the data gathering process (how to ask, how to document, participators) and the data analysis process (how to analyse, how to document, participators).

We have analysed and compared the methods, based on the criteria above, in terms of strengths and weaknesses. The outcome of the comparison should be viewed as suggestions for improvements of OOA&D. The comparison made could be seen as a systematic way of creating and arguing for the hypothesis that OOA&D could benefit from GT. The comparison is made in an ideal-typical way. This means that the selected criteria represent how the methods are described, not used. The results could be further tested and studied in future research and complemented with criteria derived from "methods in use".

The primary reason for choosing OOA&D and GT is that they are well known and frequently used. Another important reason is that we have own experiences from using these methods (Cronholm, 2002; Ågerfalk & Eriksson, 2002).

3. SHORT DESCRIPTION OF THE METHODS

3.1 OOA&D

OOA&D is a method for systems analysis and design based on an object-oriented perspective (Mathiassen et al., 2000). The object-oriented perspective offers a way of thinking about systems development. There are a number of methods designed that could be used in different phases of the systems development process. There are object-oriented methods for business analyses, systems design and programming. This implies that there are several methods, based on the object-oriented perspective, that have a common line of thought from business analyses to programming. Methods based on this perspective combine functional and data orientation. The idea is to tie information to the functionality (methods) that processes it. OOA&D is one of these methods that could be used in business analyses and information systems design. According to the authors (ibid., p.5) of the OOA&D method is the advantage with an objective oriented perspective that concepts like objects, state and behaviour are used which are general concepts suitable for describing most phenomena that can be expressed in natural language. Objects are similar to nouns, states characterise object traits, and object behaviour describes actions or influences. This implies (according to the authors) that the method can provide clear information about the system's context, which is a strength compared to traditional ISDM methods which have had a focus on data, functions and data flows. This means that the OOA&D method both have a focus on the system and its context.

3.2 Grounded theory

The aim of grounded theory is to explain phenomena in a social context. The method is iterative and comparative. The aim of the method is to generate theory from data. This means that the method is inductive and the theory is grounded in data. During the data analysis the method user is encouraged to have an open mind and be as free as possible from preconceptions (Strauss & Corbin, 1998). The constructors of GT encourage a continuous focus shift between data and conceptualisation as well as constant data comparison. Other characteristics of the method are that it is contextual, process oriented and inductive with abductive elements. Pettigrew (1989) claims that the method "provides an opportunity to examine continuous processes in context in order to draw out the significance of various levels of analysis and thereby reveal the multiple sources of loops of causation and connectivity so crucial to identifying and explaining patterns in the process of change".

Grounded theory consists of three integrated major phases: open, axial and selective coding. Briefly described, according to Strauss & Corbin (1998), open coding is the analytical process through which categories are identified and their properties and dimensions are discovered in data. Axial coding is the process of relating categories to their subcategories. In this phase an action paradigm model is suggested. The paradigm consists of the concepts conditions, actions/interactions and consequences. The aim of the paradigm model is structure the identified categories in terms of "causes end effects".

Selective coding is the process of integrating and refining the theory. There is also a phase called theoretical sampling. Theoretical sampling is a process aiming at discovering variations among concepts and to enrich the categories in terms of their properties and dimensions. Theoretical sampling means to select new data that enrich the evolving theory. The phases should be viewed as iterative and not as strictly sequential steps.

4. COMPARISON OF OOA&D AND GROUNDED THEORY

4.1 Goal and Perspective

Investigating goals means to answer the question of what should be achieved. The goal of OOA&D is well expressed and reads "to support modelling and analysis of the environment of the system". The goal of GT is "to offer more than a set of procedures". According to Strauss & Corbin (1998) the overall goal of GT is to offer a way of thinking about and viewing the world that can enrich the research. The basic goal of grounded theory is to explain phenomena in a social context.

The perspective of OOA&D is well articulated. In several ISD methods the underlying perspective is implicit. We consider the articulated perspective as

strength because it helps the method users to understand the method constructor's view of the systems development process. One could say that a method is always based on a perspective from which follow principles, conceptions, definitions and activities (Cronholm & Ågerfalk, 1999).

It is positive that both goals and perspective is declared in OOA&D. However, the presented perspective can be challenged. OOA&D represents a descriptive and objectivistic view of the system and the problem area. When creating a model, from a descriptive perspective on information systems, the business at hand constitutes the environment, i.e. the part of reality that the model claims to reflect. The model is then transformed into a computational representation and stored in the database of the system being developed (admittedly a somewhat simplified description, but sufficient for the purpose of this paper). This model of the business is then used as a source of knowledge that can be used for managing, controlling and administering the problem area. In contrast to this GT takes an action-oriented perspective of the world where actions/interactions are emphasized. This means that the identified categories are seen as and classified as conditions, actions or consequences. This action-oriented perspective emphasizes what people do. This action-oriented approach to identify categories is line with a language action perspective of information system (e.g. Winograd and Flores, 1986). In the language action perspective an information system is not regarded as an image of reality that stores true information about the world, but rather as a vehicle for social action and communication within a business context.

Another difference is that GT stresses the importance of an open-minded approach (Strauss & Corbin, 1998). An open-minded approach means that the researcher should discover and explaining phenomena in a social context as free from biases and pre-categorisations as possible. OOA&D does not stress this open-minded approach in the same way. Instead, the method user is encouraged to reuse earlier solutions. An over-reuse of old structures obstructs new thinking and innovative ideas.

4.2 Concepts

Existing concepts in methods govern the method users' attention to certain "things" in the studied domain. It is therefore important that the concepts used in the method are well defined. The basic concepts in OOA&D are class, object and event. An object is an entity with an identity, status and behaviour. An object is a phenomenon in the systems environment e.g. a specific customer. A class is a description of a number of objects sharing structure, behavioural pattern and attributes. Typically we use classes to describe objects. An event is an instantaneous incident involving one or more objects. The class, object and event are the concepts that are used when the systems environment is modelled. One can say the concepts support an object-oriented thinking.

The basic concepts in OOA&D are not always consistently used. For example, the meaning of the concept of a category is not clear. In one respect it seems that the concepts of category and classes are synonyms because the method recommends users to create classes by classifying phenomena or objects into categories. These categories are used for structuring and understanding reality, and for human communication. Another ambiguity is the way the method suggests that objects should be characterised. For example, the method suggests that objects should be characterised by their events and not by their attributes. This is different compared to linguistic theory (see e.g. Saussure, 1998) where categories are created by analysing the characterising attributes (properties) of the objects.

GT consists of several concepts. The most common concepts in GT are category, property and concept. The method users are encouraged to search for patterns amongst similar concepts and create categories with properties. Each central concept in grounded theory is defined but not the relations between the concepts. Furthermore, some discussions concerning the concepts reside on an abstract level and can therefore be hard to understand. According to Bryant (2002) and Cronholm (2002) the method is frequently used but the procedures and concepts are not always understood.

Using clear definitions of concepts is especially important when there are novice users. OOA&D should benefit from a more explicit internal grounding of concepts. It would be nice if the OOA&D method was more specific about the meaning of the class and category concepts, and why objects should be characterised by their events. This is an important difference compared to GT and linguistic theory where the common procedure for classification is to classify object by means of their attributes. It should also be helpful if the method constructors presented an illustration of a conceptual model that shows how the central concepts are related to each other. In that way had the conceptual structure been more visible. This is a general advice and not something that OOA&D can benefit from GT.

4.3 Why

The importance of raising the question of why is stressed in Jayaratna (1994). Jayaratna (1994) means that the most important question in systems analysis is why there is a need for change of a business. In the same way there is a need for method user to understand why specific guidelines or activities should be carried out. Explaining why an action should be performed increases the user's understanding of the method.

The constructors of the OOA&D claim that the reason for working with OOA&D is that the concepts used in the analyses i.e. object, status and behaviour are general concepts that can be used in a convenient way for expressing information about phenomena in the problem area with the help of natural language.

This motivation is of a more general character. In GT the recommended actions for each phase are motivated. The authors of grounded theory explain why certain activities should be performed and how they relate to forthcoming activities. The motivations offered are on a detailed level and they are very informative. Clearly, OOA&D can benefit from this way of offering method support.

4.4 Structure

OOA&D consists of a number of general guidelines that can be used for performing business analyses and information systems design. The activities described in the method are structured in four perspectives (information perspective, user perspective, architectural perspective and a wholeness perspective). The activities are: analyses of the problem domain, analyses of the user domain, architecture and component design. The activities are iterative and how the activities are organised differs from project to project which implies that the use of the method is dependent on the situation where it is used. OOA&D is a well-structured method. There is a systematic way of performing actions and documenting the results. The description techniques are based on the Unified Modelling Language (e.g. Kruchten, 1999). The different parts of OOA&D are coherent. GT consists of three phases (open, axial and selective coding). These phases are not distinct since they partly overlap each other. The phases should be viewed as iterative and not as strictly sequential steps.

It is obvious that both methods offer support for a structural work. There is always a question about the degree of structure with detailed rules vs. the degree of flexibility. Our analysis shows that GT does not offer support for detailed procedure rules in the same way that OOA&D does. There is more room for flexibility in GT. This can be considered as a strength in GT. Possibilities to act flexible supports creativity. However, this can also be considered as a problem. According to Bryant (2002), the level of methodological flexibility degenerates into methodological indifference. Furthermore, this flexibility can result in superficial and ambiguous conclusions (ibid.). On the other hand, Urquhart (2002) states that one major advantage in GT is that it has well signposted procedures. One reason for these different opinions depends on if the user prefer detailed rules or a high degree of flexibility. OOA&D offers suggestions for detailed procedural rules through recommending notation forms (based on UML-notation). Detailed suggestions are often understood as a support when novice users are involved (Cronholm, 2002).

4.5 Data gathering

In OOA&D the data gathering process is important in order to be able to find relevant classes to model in the problem area. The method suggests the analyst to list as many class candidates as possible. Using a number of data sources

can support this. For example, the analyst can use his own experience about the problem domain and existing documentation. It is also suggested that the users should be involved in order to identify relevant classes. This can be done in many ways e.g. by interviews or observations of the users when they are working. Nouns are important in order to find candidates for classes because they typically describe objects. Recommended participators for the data gathering process are the system analyst and business actors.

Grounded theory is primarily a method for data analysis. However, there are recommendations for the data gathering process. According to Strauss & Corbin (1998) the data gathering process precedes of several choices and decisions concerning the usefulness of various alternative procedures, whether these are qualitative or quantitative, but also more specifically, when making choices, which qualitative and which quantitative ones would be most appropriate. Several questions for considerations are given. Examples of such considerations are: should we interview, what type or types of interview, how many interviews should we aim for and on what ground and where will we go to find the interviewees. Examples of data collections tools are interviews, observations, videotaping and notes. Strauss & Corbin (1998) means that the result of the data gathering process should be documented in written or pictures materials. As mentioned above the Strauss & Corbin (1998) claim that the method users should have an open mind when approaching the data. Rennie et al.'s (1988) interpretation of GT goes one step further and they states that a practical implication of this claim is that grounded theory researchers should avoid reading pertinent literature until the study is finished. Another interesting suggestion in GT is the alternating between data gathering and data analysis. The following statements could be found in GT: "… data collection and data analysis occur in alternating sequences. Analysis begins with the first interview and observation, which leads to the next interview and observation…" and "It is the analysis that drives the data collection" (Strauss & Corbin, 1998).

In section 4.4 when we discussed structure, we have viewed general guidelines in OOA&D as strength. However, in the context of data gathering the general guidelines can be viewed as a weakness. The guidelines for how to perform the data gathering process are to general. There are some general recommendations like "the classes are to be found in the problem area" and "reuse knowledge, ideas and patterns from earlier projects and systems". OOA&D do not tell the users *how* data should be gathered, rather it tells us *what* to do and *where* data can be gathered. This means that the user himself must figure out or assimilate knowledge from other theories/methods of how the data gathering procedure should be performed. GT raises several important questions concerning data gathering that OOA&D can benefit from. Furthermore, the idea of alternating the process of data gathering and data analysis seems useful even for ISD-processes.

4.6 Data analysis

The input to the data analysis in OOA&D is a list of candidate classes. In order to choose the classes that should be analysed there is a basic rule that says that a class or event should be in the model of the problem area if and only if the system uses information about the class. The method also suggests a number of questions that should be asked in order to analyse and evaluate the class candidates e.g.: Can you identify objects from the class?, Does the class contain unique information?, Does the class contain several objects? and Has the class a number of convenient events? The data analysis includes also identifying relationships between classes and objects. There are a number of relationships between classes and objects such as generalisation structures that describe hierarchical relationships, aggregates and association structures that describe the relationships between objects. The method users are also encouraged to describe cardinality between different objects. OOA&D does not specifically recommend participators for the data analysis process. Our interpretation is that the system analyst performs the analysis. OAA&D offers a useful notation support for how to document the analysis

The data analysis in GT is supported by a set of tools. The most important tool is "asking questions". Examples of questions to be asked are What is this about?, What is happening? and What is this an example of? This tool is well described and the aim of this tool is to support the user in order to asking generative questions. GT offers a high support for making abstractions and generating categories but does not offer a support for a clear notation. The suggested notation also lacks precision. In other words there is a high degree of freedom when illustrating and documenting the results of axial coding. If possible grounded theory should be performed as cooperative work. Babchuk (1996) claims, "whenever possible grounded theory should be a collaborative enterprise".

Our analysis shows that OOA&D offers a good support for data analysis. The method is focused upon general principles and not on rigid details of how to perform the analysis. Unfortunately, the method does not tell us how the data should be categorised into classes. In this case, OOA&D can benefit from GT. The bottom-up approach in GT is well supported. We don't say that OOA&D is a top-down approach. Of course, there exists a bottom-up thinking. But, this way of thinking when searching for more abstract or general classes should be more transparent through offering supportive questions like those that exists in GT.
We also think that OOA&D can benefit from GT concerning the use of the concept of context. GT recommends the method user to contextualize phenomena. Contextualizing phenomena is supported by asking questions like whom, where, when, why, how and with what results.

5. CONCLUSIONS

In the introductory section we stated that "on a basic level both OOA&D and GT aim at present a support for asking good questions and to answer these questions" in a knowledge acquisition process. One observation is that OOA&D has good notation techniques for expressing the answers of the questions but is worse when it comes to recommending questions to be asked. Vice versa, GT seems to be good at suggesting questions to be asked but worse when it comes to suggest how the answers of the questions should be documented.

One reason for this difference could be that GT is not developed in the area of ISD. In the ISD-field there is a tradition of using illustrative diagrams as means for communication between systems developers and for requirement specifications. There are other demands of language precision since the specification is to be implemented in computers. On the other hand, GT has its origin from the subject of sociology where there is a long tradition of studying people's behaviour. In this field there is a need for well-developed data gathering and analysis processes. In this respect, OOA&D and probably other ISD methods could learn from GT.

Another observation is that GT stresses the importance of an open-minded approach. An open-minded approach means that the researcher should discover and explaining phenomena in a social context as free from biases and pre-categorisations as possible. OOA&D does not stress this open-minded approach in the same way. Instead, the method user is encouraged to reuse earlier solutions. The message of the recommendation in GT is; search for qualitative data. The message of the recommendation in OOA&D is; be effective. We think that this difference is an effect of the different aims of the two methods. The aim of design in OOA&D makes it meaningful to look for design patterns in order to reuse good solutions based on experience. This can be effective in several ways because it can both speed up the systems development process and create a better design. The risk involved is that an exaggerated reuse can lead to that unproblematized solutions are suggested.

A third observation from the analysis is about participation. Goldkuhl et al. (1997) raise the questions "who puts the question" and "who is answering". Goldkuhl et al. means that these questions are not fully covered in ISD methods. In OOA&D these questions are discussed for the data gathering process but not for the data analysis process. According to Goldkuhl et al. (1997) there should be a support for co-operation forms i.e. how different method users interact and co-operate when performing method-guided work. Babchuk (1996) claims, "whenever possible grounded theory should be a collaborative enterprise". The assumption behind is that "four eyes see more than two eyes". We interpret these statements as advises for reaching more qualitative results.

A fourth observation is that the analysis has showed that one of the most interesting results is that OOA&D and GT represents different perspectives of the world and how the world is constituted. GT takes an action-oriented perspective

of the world where actions/interactions are emphasized. This means that identified categories are seen and classified as conditions, actions or consequences. OOA&D represents a descriptive and objectivistic view of the system and the problem area. This means that the world is described as classes, objects and events. This is an important difference. The difference means to perceive the world as an object system or as an action system. We think that in order to really understand a business and how IS are used in that business it is important to analyse the world as an action system. The aim of this paper has been to investigate how OOA&D could benefit from GT on the method level. As future research we propose a deeper comparison between the different worldviews represented in OOA&D and GT. This is of interest because the basic ontological assumptions made give guidelines for what we really can know about the world and how this knowledge should be acquired.

As future research we propose a broader study of several ISD methods (other OOA&D as well as other ISDM-types) and research methods. We also propose a study of the opposite question "what can qualitative research methods learn from ISD methods?". The findings of our analysis concern OOA&D and GT. Therefore we are not able to generalise the findings. But, these findings are true for the studied representatives of the methods and are therefore something to consider when asking the general question what could ISD methods learn from qualitative research methods. The comparison made in the paper can be seen as a hypothesis that ISD methods could benefit from qualitative research methods especially when it concerns data gathering and data analyses.

REFERENCES

1. Alvesson M and Sköldberg, K (2000) *Reflexive Methodology: New Vistas for Qualitative Research*, SAGE, Thousand Oaks, CA
2. Babchuk W. (1996) *Glaser or Strauss? Grounded Theory and Adult Education*, presented at Midwest Research-To Practice Conference in Adult, Continuing and Community Education, University of Nebraska, Lincoln, NE
3. Bryant A (2002). *Re-Grounded Theory*, in Journal of Information Technology Theory and Application (JITTA), 4:1, 25-42.
4. Cronholm S (2002). *Grounded Theory in Use - a Review of Experiences*. In Proceedings of the first European Conference on Research Methodology for Business and Management Studies (ECRM 2002) (Remenyi D, ed). 29-30 April 2002. Reading University, Reading, UK
5. Cronholm S, Ågerfalk P (1999). *On the Concept of Method in Information Systems Development*. In Proceedings of the 22nd Information Systems Research In Scandinavia (IRIS 22), Käkölä T (ed). 7–10 August Keuruu, Finland
6. Glaser B (1992). *Basics of Grounded Theory Analysis*. Sociology Press, Mill Valley, CA.

7. Glaser B, Strauss A (1967), *The discovery of grounded theory*, Aldine, New York
8. Goldkuhl G, Lind M, Seigerroth U (1997) *Method integration as a learning process*, accepted to "the 5th Annual Conference on Methodologies Training and education of methodology practitioners and researchers", The British Computer Society, Preston
9. Heidegger M (1975). *The Basic Problems of Phenomenology*. Indiana University Press.
10. Iivari J, Hirschheim E & Klein H (2001). *A Dynamic Framework for Classifying Information Systems Development Methodologies and Approaches*. Journal of Management Information Systems. Winter 2000-2001, Vol 17, No 3, pp 179-218.
11. Jayaratna N (1994). *Understanding and Evaluating Methodologies*. McGraw-Hill Book Company, London
12. Kruchten P (1999). *The Rational Unified Process: an Introduction*. Addison Wesley Inc. Reading, MA.
13. Mathiassen L, Munk-Madsen A, Nielsen P A and Stage J. (2000) *Object-Oriented Analysis & Design*. Marko Publishing House, (in English, modernized and completely revised version of 1.8).
14. Patton M Q (1990) *Qualitative Evaluation and Research Methods*, second edition, Sage Publications, London
15. Pettigrew, A.M. (1989) *Issues of Time and Site Selection in Longitudinal Research on Change*, in The Information Systems Research Challenge: Qualitative Research Methods, J.I Cash Jr. and P.R. Lawrence (eds.), Harvard Business School Press, Boston, MA, 1989, pp. 13-19.
16. Rennie D., Phillips J. & Quartaro G. (1988) *Grounded Theory: A promising approach to conceptualization in psychology*? , Canadian Psychology, Vol 29(2), pp 139-150
17. Saussure F. (1998) *Course in general linguistics*, Pergamon, Oxford
18. Strauss A., Corbin J (1998) *Basics of Qualitative Research: Techniques and Procedures for Developing Grounded Theory*, Sage Publications, Thousand Oaks, CA
19. Urquhart C (2002). *Regrounding Grounded Theory – Or Reinforcing Old Prejudices*, in Journal of Information Technology Theory and Application (JITTA), 4:3, 43-54.
20. Walsham G (1993) *Interpreting Information Systems in Organisations*, Wiley & Sons
21. Winograd T, Flores F. (1986). *Understanding computers and cognition: A new foundation for design*. Ablex. Norwood.
22. Ågerfalk Pär J and Eriksson Owen (2002) *Pragmatization of Conceptual Modelling, In Information Systems and the Future of the Digital Economy*, Proceedings of the Xth European Conference on Information Systems (Ecis 2002),Vol. 1 (Ed, Wrycza S) Gdansk, Poland, pp. 416-428.