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These proceedings contain the papers of the Second International Conference on Enterprise Information Systems, which was organised by the School of Computing at Staffordshire University, UK, and the Escola Superior de Tecnologia of Setúbal, Portugal, in cooperation with the British Computer Society and the International Federation for Information Processing, Working Group 8.1. The purpose of this 2nd International Conference is to bring together researchers, engineers and practitioners interested in the advances in, and business applications of information systems.

The papers, posters and the special keynote lectures demonstrate the vitality and vibrancy of the field of Enterprise Information Systems. The research papers included here were selected from among 143 submissions from 32 countries in the following four areas: Enterprise Database Applications, Artificial Intelligence Applications and Decision Support Systems, Systems Analysis and Specification, and Internet and Electronic Commerce. Every paper had at least two reviewers. We would like to thank all the members of the Programme Committee and the reviewers for their work in reviewing and selecting the papers that appear in this volume. We would also like to thank all the authors who have submitted their papers to this conference, and would like to apologise to the authors that we were unable to include and wish them success next year.

A variety of special keynote lectures complement the technical papers in the four areas: a common keynote speech about "Making the most of your Knowledge" by Ian Ritchie, two keynote speeches for each area which are listed on the next page, pre-conference tutorials and workshops. Special thanks are due to our keynote speakers who have kindly accepted our invitation and we wish them a safe journey home.

As we all know, producing a conference requires the effort of many individuals. We wish to thank all members of our organising committee, listed in a prior page, whose help and commitment were invaluable. Special thanks to Caroline Lees, Geth Udall, Paul Wheeler, and Jose Cordeiro for their hard work and their patience. The conference acknowledges the sponsorship of ICEP, EPSRC and Instaffs. Through their generosity the conference was able to moderate the registration fees. And we wish to thank Staffordshire University for hosting the conference.

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ICEIS 2000 Programme co-chairs.

MEASURES TO GET BETTER QUALITY DATABASES

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Abstract: Due to the growing complexity of information systems, continuous attention to and assessment of the quality of databases, which are the essential core of information systems, it is necessary to produce quality information systems. In a typical database design a conceptual schema which specifies the requirements of the database is first built. Even more conceptual schemas determine what information can be represented by an information system, so their quality can have a significant impact on the quality of the database which is ultimately implemented. Unfortunately, most of the work regarding conceptual schemas quality merely list properties, without giving quantitative measures that assess the quality of such models in an objective way. In this work, we will propose a set of metrics for measuring the complexity of the well known Entity Relationship schemas, which will allow database designers to measure the complexity of conceptual designs in order to improve their quality. We will also put them under theoretical validation following Zuse's formal framework.

Key words: Quality, Database design, Complexity metrics, Software metrics.

1. INTRODUCTION

Quality in information systems (IS) is one of the most pressing challenges facing organisations today. Many companies are now realising how critical their IS are to the success of their businesses.

Due to the growing complexity of IS, continuous attention to and assessment of the quality of databases, which are the essential core of IS, are necessary to produce quality information systems (Van Vliet, 1993).

In a typical database design a conceptual schema which specifies the requirements about the database is developed first. . Even more conceptual schemas determine what information can be represented by an information system (Feng, 1999), so their quality can have a significant impact on the quality of the database which is ultimately implemented.

Information systems developed with an eye toward reducing complexity will usually be much easier to maintain after delivery (Drake, 1999).

Recently, some interesting frameworks have been proposed addressing quality in conceptual schemas (Moody and Shanks, 1994; Krogstie et al., 1995; Shanks and Darke, 1997; Moody et al., 1998).Unfortunately, most of these frameworks merely list quality factors, without giving quantitative measures that assess the quality of such conceptual schemas in an objective way.

Quality factors are not enough on their own to ensure quality in practice (Moody, 1998). The objective should be to replace intuitive notions of quality in conceptual schemas with formal, quantitative measures. These will reduce subjectivity and bias in the evaluation process.

Software measurement is maturing and leading to a more sophisticated understanding of better ways to produce better products (Pflegger, 1997).

Software engineers have proposed a plethora of metrics for software products, processes and resources (Melton, 1996; Fenton and Pflegger, 1997). Many of the metrics and quality models currently available can be applied only after a product is complete, or nearly complete. They rely upon information extracted from the implementation of the product. This provide information is too late to help improve internal product characteristics prior the completion of the product. Thus, there is a need for metrics and models that can be applied in the early stages of development . Particularly in what applied to conceptual schemas which will ensure that design have favourable internal properties that will lead to the development of quality IS. This measurement approach would give developers an opportunity to fix problems, remove non-conforming design attributes, and eliminate unwanted complexity early in the development cycle. This should then reduce rework during implementation and maintenance.

One of the few published works about metrics for conceptual schemas is Moody (1998); some of them are objectively calculated whereas others are based on expert ratings.

The quotes above show that is very important to measure the complexity of conceptual schemas and understand their contribution to the overall IS complexity. We must be conscious, however, that a general complexity measure is "*the impossible holy grail*" (Fenton, 1994). Henderson-Sellers (1996) distinguishes three types of complexity, among which he quoted "product complexity". This is our focus when we refer to the concept of complexity.

As in other aspects of Software Engineering, proposing techniques and metrics is not enough. It is also necessary to put them under formal and empirical validation, in order to assure their utility. Validation is critical to the success of software measurement (Kitchenham, 1995).

Regarding formal validation for every measurement we have to be aware of its scale type (Zuse, 1998). Knowledge of scale type tells us about limitations on the kind of mathematical manipulations that can be performed. The scale type of a measure affects the types of operations and statistical analyses that can be sensibly applied to the data values. (Fenton and Pflegger, 1997).

In section 2 we will propose a set of metrics for Entity Relationship (ER) schemas, thus allowing database designers to measure the complexity of their designs from the early stages of information systems life-cycle. Next, in section 3 we will validate them following the framework of software measurement proposed by Zuse (1998) with the goal of determining some properties of the proposed metrics, as well determining each scale type. Lastly, section 5 summarises the paper, draws on our conclusions, and presents our future research directions.

2. A METRIC SUITE FOR CONCEPTUAL SCHEMAS

In this section we propose a set of metrics to assess the complexity of E/R schemas. These metrics are based on the complexity theory which defines the complexity of a system by the number of components in the system and the number of relationships among the components. Because our aim is to simplify the E/R schema, the objective will be to minimise the value of these metrics. This minimises the development and maintenance effort of the system that will me implemented later.

We classify these metrics the following categories:

2.1 Metrics with regard to entities

NE metric

We define the Number of Entities metric (NE) as the number of entities within the E/R schema.

2.2 Metrics with regard to attributes

NA metric

We-define the Number of Attribute metric (NA) as the number of attributes that exist within the E/R schema. In this number we include simple attributes, composite attributes and also multivalued attributes, each of one take the value 1.

DA metric

An E/R schema is minimal when every aspect of the requirements appears once in the schema, i.e. an E/R schema is minimal if it does not have any redundancies.

One of the sources of redundancies in the E/R schemas is the existence of derived attributes. An attribute is derived when its value can be calculated or deduced from the values of other attributes.

We define the Derived Attributes metric (DA) as the number of derived attributes existing in the E/R schema.

CA metric

We define the Composite Attribute metric (CA) as the number of composite attributes within an E/R schema. A composite attribute is an attribute composed of a set of simple attributes.

MVA metric

The Multivalued Attributes metric (MVA) is defined as the number of multivalued attributes within the E/R schema. A multivalued attribute is an attribute that can take several values for an individual entity.

2.3 Metrics with regard to relationships

NR metric

We define the Number of Relationships metric (NA) as the number of relationships that exist within the E/R schema. In this number we only include binary relationships.

M-NR metric

The M:N Relationships metric (M:NR) is defined as the number of M:N relationships within the E/R schema.

N-AryR metric

The N-ary Relationships metric (N-AryR) is defined as the number of N-ary relationships (not binary) within the E/R schema.

NIS_AR metric

We define the Number of IS_A Relationships metric (NIS_AR) as the number of relationships IS_A (generalisation or specialisation) that exist within the E/R schema. In this case, we consider one relationship for each pair child-parent within the IS_A relationship.

RR metric

Another source of redundancy in an E/R schema is the existence of redundant relationships. We define Redundant Relationship metric (RR) as the number of relationships that are redundant in the E/R schema.

3. VALIDATION OF METRICS

Several frameworks for measuring characterisation have been proposed (Briand et al., 1996; Morasca and Briand, 1997; Weyuker, 1988; Zuse, 1998). In this paper we will follow the formal framework of Zuse (1998)) in order to describe the properties of the metrics defined above.

3.1 Zuse´s formal framework

In this paragraph we present a formal description of the proposed metrics in the formal framework of Zuse who defines a set of properties for measures, which characterise different measurement structures (see table 1). This framework is based on an extension of the classical measurement theory, which gives a sound basis for software measures, their validation and criteria for measurement scales.

An empirical relational system is represented as:

$$A = (A, \bullet >=, o)$$

Where A is a no empty set of objects, • >= is a empirical relation in A and o is a binary closed operation (concatenation) in A.

There exist five scale types defined by admissible transformations. They are, in hierarchical order: nominal, ordinal, interval, ratio and absolute. Each scale type is defined by admissible

MODIFIED EXTENSIVE STRUCTURE	INDEPENDENCE CONDITIONS	MODIFIED RELATION OF BELIEF
Axiom1: (A, • >=) (weak order) **Axiom2**: A1 o A2 • >= A1 (positivity) **Axiom3**: A1 o (A2 o A3) ≈ (A1 o A2) o A3 (weak associativity) **Axiom4**: A1 o A2 ≈ A2 o A1 (weak commutativity) **Axiom5**: A1 • >= A2 ⇒ A1 o A • >= A2 o A (weak monotonicity) **Axiom6**: If A3 • > A4 then for any A1, A2, then there exists a natural number n, such that A1o nA3 • >A2 o nA4 (Archimedean axiom)	**C1**: A1 ≈ A2 ⇒ A1 o A ≈ A2 o A and A1 ≈ A2 ⇒ A o A1 ≈ A o A2 **C2**: A1 ≈ A2 ⇔ A1 o A ≈ A2 o A and A1 ≈ A2 ⇔A o A1 ≈ A o A2 **C3**: A1 • >= A2 ⇒ A1 o A • >= A2 o A, and A1 • >= A2 ⇒ A o A1 • >= A o A2 **C4**: A1 • >= A2 ⇔ A1 o A • >= A2 o A, and A1 • >= A2 ⇔A o A1 • >= A o A2	**MRB1**: ∀ A, B ∈ ℑ: A • >= B or B • >= A (completeness) **MRB2**: ∀ A, B, C ∈ ℑ: A • >= B and B • >= C ⇒ A • >= C (transitivity) **MRB3**: ∀ A ⊇ B ⇒ A • >= B (dominance axiom) **MRB4**: ∀ (A ⊃ B, A ∩ C = ϕ) ⇒ (A • >= B ⇒ A U C • > B U C) (partial monotonicity) **MRB5**: ∀ A ∈ ℑ: A • >= 0 (positivity)
As we know, binary relation • >= is called weak order if it is transitive and complete: A1 • >= A2, and A2 • >= A3 ⇒ A1 • >= A3 A1 • >= A2 or A2 • >= A1	Where A1 ≈ A2 if and only if A1 • >= A2 and A2 • >= A1, and A1 • > A2 if and only if A1 • >= A2 and not (A2 • >= A1).	

Table 1. Zuse's formal framework properties

transformations. Software measurement starts with the ordinal scale (Zuse, 1998). Measures may be classified in a scale type, depending on whether they assume an extensive structure or not. When a measure accomplishes this structure, it also accomplishes the independence conditions and can be used on the ratio scale levels.

If a measure does not satisfy the modified extensive structure, the combination rule (that describes the properties of the software measure clearly) will exist or not depending on the independence conditions. When a measure assumes the independence conditions but not the modified extensive structure, the scale type is the ordinal scale (the characterisation of measures above the ordinal scale level is very important because we cannot do very much with ordinal numbers).

In the next paragraph we present the formal description of the DA metric. First we define the concatenation operation and the combination function, after we test the modified extensive structure.

3.2 Characterisation of the proposed metrics

For our purposes, the Empirical Relational System could be defined as:

E =(E, •>=, o)

Where E is a non-empty set of ER schemas, •>= is the empirical relation "more or equal complex than" on E and o is a closed binary (concatenation) operation on E. In our case we will consider the concatenation operation ERCon. Two ER schemas, E1 and E2 are concatenated by the concatenation operation ERCon, adding a new relationship between them, as it is shown in figure 1.

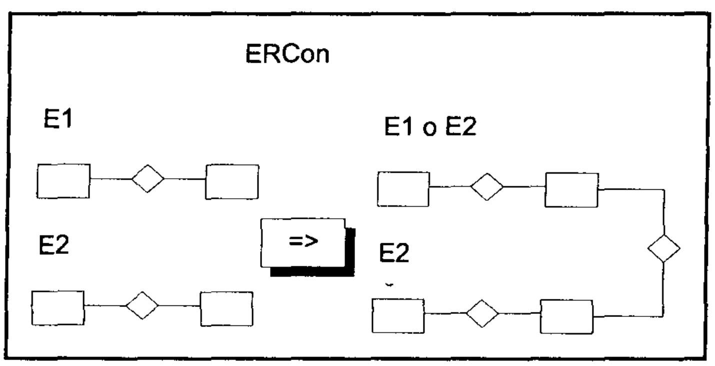

Figure 1. Entity Relationship Concatenation

3.2.1 Characterisation of the DA metric

The DA metric is a mapping: DA:E->$\Re$, the following holds for all E/R schemas
Ei and Ej $\in$ E: Ei •>= Ej $\Leftrightarrow$ DA(Ei) >=DA(Ej)
We can define the combination rule for DA in the following way:
DA(Ei o Ej) = DA(Ei) + DA(Ej), ie., the number of derived attributes of E1oE2, is equal to the sum of the number of derived attributes of E1 and E2. We do not show attributes in figure 1, for the sake of brevity.
We will verify if the DA metric fulfils all of the axiom of the Modified Extensive Structure.

DA fulfils the first axiom of weak order, because if we have two E/R schemas E1 and E2, it is obvious that DA(E1) >= DA(E2) or DA(E2) >= DA(E1) (completeness) and let E1, E2 and E3 three E/R schemas, transitivity is always fulfilled: DA(E1) >= DA(E2) or DA(E2) >= DA(E3), then DA(E1) >= DA(E3).

DA also fulfils positivity, because the number of derived attributes of E1 o E2 will be always greater or equal than the number of derived attributes of E1. In the case that E2 has no derived this attributes DA(E1 o E2) = DA(E1), and if E2 has derived attributes DA(E1 o E2) > DA(E1).

DA also fulfils weak associativity, because the number of derived attributes do not depend on the order with which we associate the ER schemas in order to apply the concatenation operation ERCon.

DA also fulfils weak conmutativity. Taking into account the definition of ERCon, the order in which we concatenate the ER schemas does not affect to the number of derived attributes.

DA also fulfils weak monotonicity, because if we the number of derived attributes of E1 is greater or equal than the number of derived attributes of E2, and after we do E1 o E and E2 o E, it will result that DA(E1oE) >=DA(E2oE).

DA also fulfils the Arquimedean axiom. Let E1, E2, E3 and E4 four E/R schemas, and DA(E3)>D(E4) it is easy to see that there exists one number n such that DA(E1onE3) > DA(E2onE4), ie. if we concatenate n times E1 with E3, as DA(E3)>DA(E4), for some value of n it will happen that DA(E1 o nE3) > DA(E2 o nE4).

Seeing that DA metric fulfils all of the axiom of the Modified Extensive Structure, we can conclude that this metric is in ratio scale.

3.2.2 Rest of metrics

Table 2 summarises the results obtained after applying Zuse's formal framework to the rest of metrics presented in section 2.

	CONCAT OPER	COMBINATION RULE	MOD EXT STRUCTURE						SCALE
			1	2	3	4	5	6	
NE	ERCon	NE(EioEj)=NE(Ei)+NE(Ejj)	Y	Y	Y	Y	Y	Y	Ratio
NA	ERCon	NA(EioEj)=NA(Ei)+NA(Ejj)	Y	Y	Y	Y	Y	Y	Ratio
DA	ERCon	DA(EioEj)=DA(Ei)+DA(Ejj)	Y	Y	Y	Y	Y	Y	Ratio
CA	ERCon	CA(EioEj)=CA(Ei)+CA(Ej)	Y	Y	Y	Y	Y	Y	Ratio
MVA	ERCon	MVA(EioEj)= MVA(Ei)+MVA(Ej)	Y	Y	Y	Y	Y	Y	Ratio
NR	ERCon	NR(EioEj)=NR(Ei)+ NR(Ejj)+1	Y	Y	Y	Y	Y	Y	Ratio
M:NR	ERCon	M:NR(EioEj)= M:NR(Ei)+M:NR(Ej)	Y	Y	Y	Y	Y	Y	Ratio
N:AryR	ERCon	N-AryR(EioEj)=N-ryR(Ei)+ N:aryR(Ej)	Y	Y	Y	Y	Y	Y	Ratio
NIS_AR	ERCon	NIS_AR(EioEj)= NIS_AR(Ei)+NIS_AR(Ej)	Y	Y	Y	Y	Y	Y	Ratio
RR	ERCon	RR(EioEj)=RR(Ei)+ RR(Ej)	Y	Y	Y	Y	Y	Y	Ratio

Table 2. Results for the rest of metrics

4. CONCLUSIONS

We have presented eleven objective and automatically computed metrics for evaluating the complexity of E/R schemas.

We have also put them under formal validation following Zuse's formal framework in order to demonstrate all of the properties that a metric fulfils and the scale type of each metric. All of the proposed metrics are in ratio scale, which as cited above, have an important significance in the scope of software measurement.

We should comment that our proposal cannot be considered as a final proposal. Instead, it is a starting point and we require feedback in order to improve it.

We are in agreement with a lot of authors like Fenton and Pflegeer (1997), Kitchenham (1995), Schnneidewind (1992) that it is necessary to put metrics under empirical validation in order to demonstrate that metrics really function in practice. Regarding this, we are carrying out some experimentation not only with controlled experiments but also with "real" cases taken from several companies, with the objective to assess these metrics as predictors of maintenance efforts, and there fore, determine whether they can be used as early quality indicators.

Due the increasing and fast diffusion of the information systems developed following the object oriented paradigm, as future work, we will tailor the proposed metrics, in order to address the complexity of diagrams using UML (Booch, 1998). Furthermore, we will not only address complexity, we will also focus on our research related to measuring other quality factors like those proposed in the ISO 9126 (1999).

We are building a metric tool, called MANTICA, for collecting, analysing and visualising metric values, with the goal of obtain threshold values that can help database designers in the early stages of the information system life-cycle.

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REFERENCES

Booch, G., Rumbaugh, J. and Jacobson, I. 1998. The Unified Modeling Language User Guide. Addison-Wesley.

Briand, L., Morasca, S. and Basili, V. 1996. Property-Based Software Engineering Measurement. IEEE Transactions on Software Engineering, 22 (6). 68-86.

Drake, T. 1999. Metrics Used for Object-Oriented Software Quality. Handbook of Object Technology. Editor-in-Chief Zamir S. (Section IX-Object Oriented Metrics). CRC Press.

Feng, J. 1999. The "Information Content" problem of a conceptual data schema and a possible solution. Proc. of the 4th UKAIS Conference: Information Systems-The Next Generation, University of York, 257-266.

Fenton, N. 1994. Software Measurement: A Necessary Scientific Basis. IEEE Transactions on Software Engineering, 20(3), 199-206.

Fenton, N. and Pfleeger, S. L. 1997. Software Metrics: A Rigorous Approach 2nd. edition. London, Chapman & Hall.

Henderson-Sellers, B. 1996. Object-oriented Metrics - Measures of complexity. Prentice-Hall, Upper Saddle River, New Jersey.

ISO/IEC 9126-1.2 (1999). Information technology- Software product quality – Part 1: Quality model.

Kitchenham, B., Pflegger, S. and Fenton, N. 1995. Towards a Framework for Software Measurement Validation. IEEE Transactions of Software Engineering, 21(12), 929-943.

Krogstie, J., Lindland, O.I. and Sindre, G. 1995. Towards a Deeper Understanding of Quality in Requirements Engineering, Proceedings of the 7th International Conference on Advanced Information Systems Engineering (CAISE), Jyvaskyla, Finland, 82-95.

Melton, A. 1996. Software Measurement, London, International Thomson Computer Press.

Moody, L. and Shanks G. 1994. What Makes A Good Data Model? Evaluating The Quality of Entity Relationships Models. Proceedings of the 13th International Conference on Conceptual Modelling (E/R '94), Manchester, England, 94-111.

Moody, L. 1998. Metrics For Evaluating the Quality of Entity Relationship Models. Proceedings of the Seventeenth International Conference on Conceptual Modelling (E/R '98), Singapore, November 16-19.

Moody, L., Shanks, G. and Darke, P. 1998. Improving the Quality of Entity Relationship Models - Experience in Research and Practice. Proceedings of the Seventeenth International Conference on Conceptual Modelling (E/R '98), Singapore, 255-276.

Morasca, S. and Briand, L.C. 1997. Towards a Theoretical Framework for measuring software attributes. Proceeding of the Fourth International, Software Metrics Symposium, 119-126.

Pfleeger, S. 1997. Assessing Software Measurement. IEEE Software, March/April, 477-482.

Shanks, G. and Darke, P. 1997. Quality in Conceptual Modelling: Linking Theory and Practice. Proc. of the Pacific Asia Conference on Information Systems (PACIS'97), 805-814.

Schneidewind, N. 1992. Methodology For Validating Software Metrics. IEEE Transactions of Software Engineering, 18(5), 410-422.

Van Vliet, J. 1993. Software Engineering: Principles and Practice, John Wiley and Sons, Chichester, England.

Weyuker, E. 1988. Evaluating software complexity measures. IEEE Transactions on Software Engineering, 14(9), 1357-1365.

Zuse, H. 1998. A Framework of Software Measurement. Berlin, Walter de Gruyter.

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7th May 2001

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I look forward to seeing you again at ICEIS 2001 in Setubal, Portugal.
Best wishes.

Yours

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