

## A PROPOSED MODEL OF PERCEPTUAL OBJECTS

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## KEYWORDS

perceptual, model, symbol, function, affect, order

## ABSTRACT

This paper expands on the GENERAL REFERENCE MODEL FOR AEC PRODUCT DATA (GRM) described in the International Standards Organization Document 3.2.2 of ISO TC184/SC4/WG1 dated 87/8/28, and suggests the possibility of some changes in the GRM. Accompanying these changes, the paper proposes a model of the perceptual object. It makes an argument for four categories: function, affect, symbol, and order, based in the different person-object relations that can occur. The paper proposes their further development and inclusion in the GRM.

## THE GENERAL REFERENCE MODEL

The GRM proposes five categories (orthogonal discriminators): STAGE, LEVEL, STATUS, ROLE, and TYPE. STAGE defines product life cycle phase, LEVEL defines abstractness of product description, STATUS defines decision status, ROLE distinguishes between original and replacement objects, and TYPE defines the kind of Product Definition Unit (PDU).

## THE STAGE CATEGORY

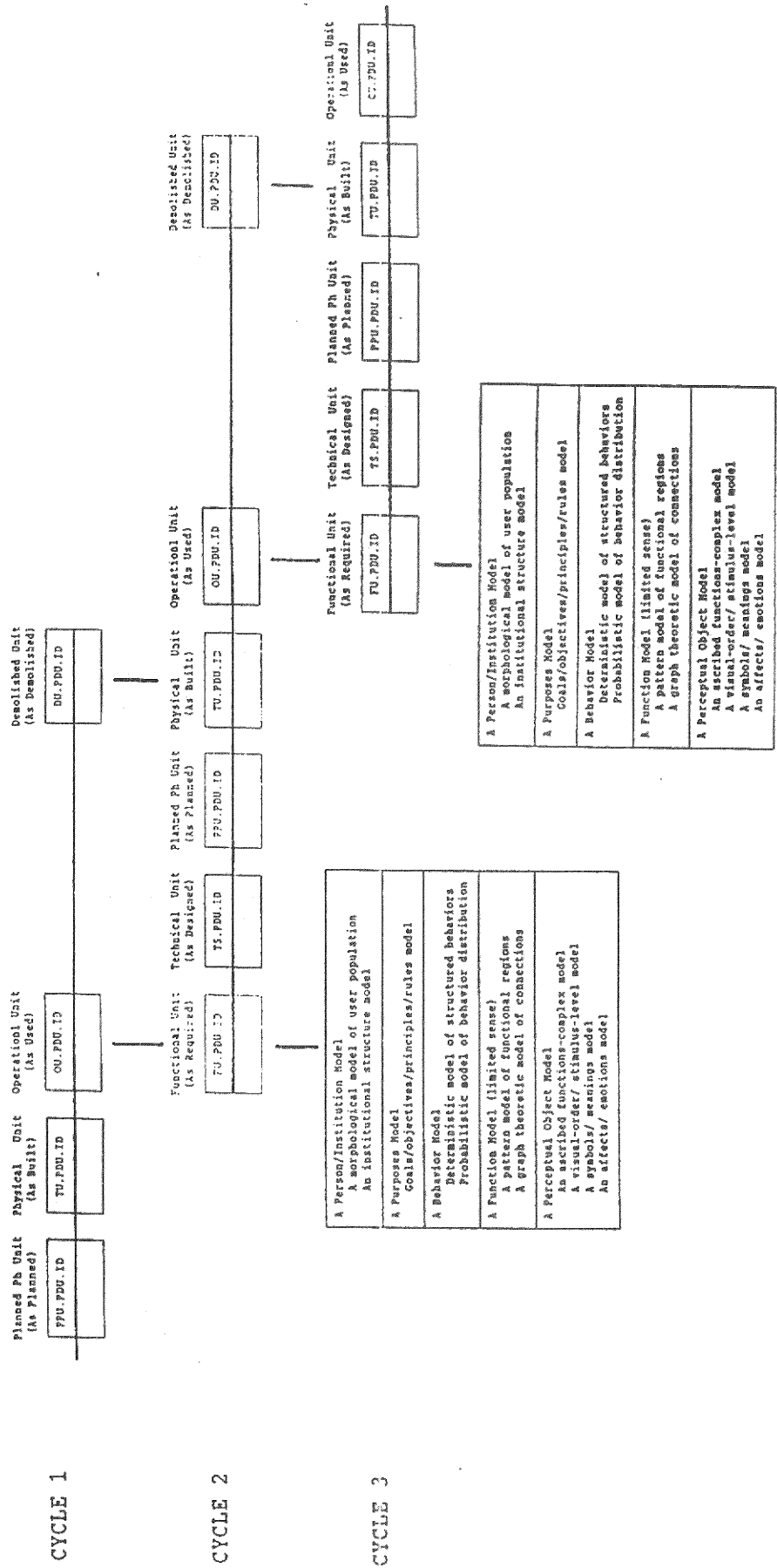
The STAGE category lists a life cycle sequence. The different stage names are accompanied by descriptive phrases as follows:

Functional Unit:	As Required
Technical solution:	As Designed
Planned Physical Unit:	As Planned
Physical Unit:	As Built
Operational Unit:	As Used/Maintained
Demolished Unit:	As Demolished

While the stages themselves are reasonable, their use in the Temporal Model (GRM, Diagram B.1) might not handle the complexity in a product life sequence. Figure 1. proposes a modification. It is based in an iterative (and cyclical) view of the product-in-use. This might be



Figure 1.



compared with the cyclical description of design process proposed by Archer [1]. Figure 1 shows relationships between three cycles.

The Operational stage of an earlier cycle corresponds with the Functional stage of the next cycle. This emphasizes that requirements for a new product invariably grow out of the deficiencies in a current product. It suggests that descriptive detail in the Functional stage have counterpart detail in the Operational stage. It suggests a need for expanded model detail in these stages. Notice, also, that the Demolished stage of an earlier cycle corresponds with the Physical Unit stage of the next. More complex procedures for taking products into modified use or disuse can be represented. This organization of the STAGE category suggests the need for a different organization in the TYPE category.

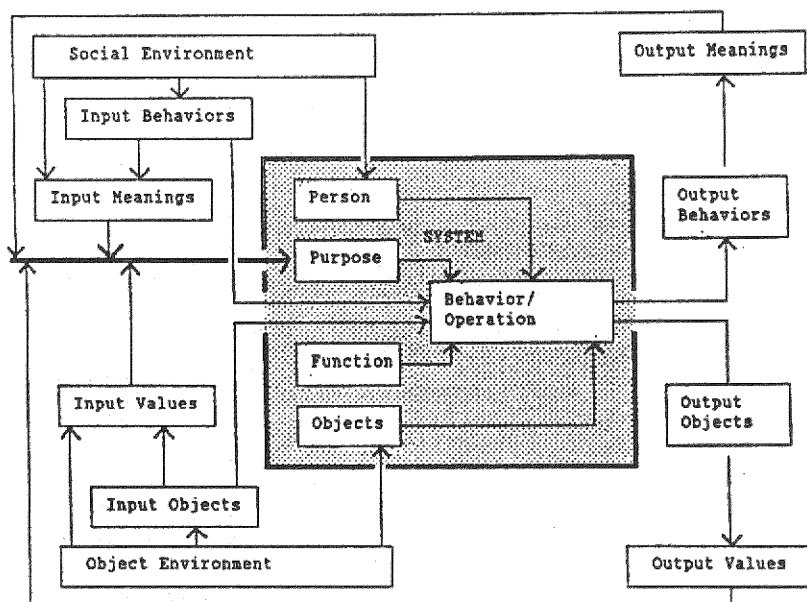
#### THE ROLE CATEGORY

Incidental to these changes, Figure 1 proposes that the ROLE category be replaced by a CYCLE identification category.

#### SUPPORTING MODELS FOR THE STAGE CATEGORY

Consider, now, what model detail is needed in the Functional and Operational stages of the model. Figure 2. depicts the operation of a building/product. It presumes interactions between staff and their product complex (the system), and clients or objects (as inputs and

Figure 2.



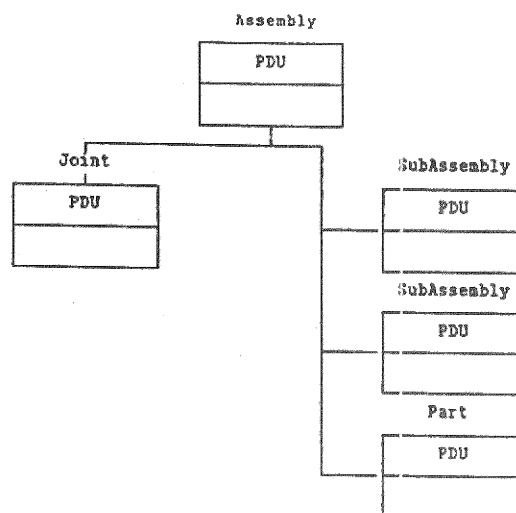
outputs to the system). It presumes operation within a social and physical environment. If the system achieves its purposes, a fit must exist between the elements of the system, its inputs, its outputs, and its environment. When misfit occurs, entry into a new CYCLE like those shown in Figure 1. can begin. Alexander's early work [2] [3] placed strong emphasis on the notion of "misfit" in design.

Supporting models are needed to represent components of this system; they are listed in the inset boxes of Figure 1. These components are derived from the writer's theory of design process [4], and are discussed below. While this paper does not propose all of these as components in the GRM, they might be needed, in constructing PDU descriptions for Functional and Operational stages. Several examples can illustrate their use. An Institutional model should be able to "map" closely to a Function model, and both map at a macro level to the Operational stage or Functional stage models. A Behavior model should be able to map to a corresponding Functional region, and both map at a micro level to the Operational and Functional stage models. A Purposes model should map to the several parts of a Perceptual Object model (function, symbol, affect, and order), and both should map to the Operational and Functional stages model. See the section below describing a Perceptual Object model.

#### THE TYPE CATEGORY

Figure 3. proposes a simpler diagram for the TYPE category; it suggests that all PDU's can be defined by a Joint descriptor combined with a list of the components that are joined. This approach requires some expansion of what is ordinarily thought of as a joint. Consider three different cases.

Figure 3.



A PDU that is an Arrangement is joined by the behavior of persons (or other external objects serviced by the arrangement). The required functional connectivity is what defines a joint for an arrangement. A PDU that is an Assembly of physical components is joined by physical connectors. The configuration of the connection is described geometrically with a specification of components. A PDU that is an integral Part consists of geometric descriptions (sometimes complex in themselves), that are joined by boolean operators.

#### A PROPOSED PERCEPTUAL OBJECT MODEL

These proposed changes show that the GRM could view the building as an object-of-use. The writer's theory of design process [4], used five categories to organize design information. Those categories were a means-ends series, organized by the statement: OBJECTS provide FUNCTIONS that can support BEHAVIORS to achieve PURPOSES for PERSONS. Research for that work had found similar categories in several disciplines ([4] pp.57-70). Experience showed that architectural program information could be classified by this PERSON-OBJECT spectrum.

Taken literally, this scheme presents a "tool" view of the object. Another classification dimension is needed to deal with the full range of object qualities in architecture. It can be based in the different perceptual relationships using PERSON-OBJECT terms. Four such relationships are:

CATEGORIES	PERSON/OBJECT RELATION
Function/Purpose	P ----> O
Affect/Emotion	O ----> P
Symbol/Meaning	P -(O) > P
Order/Stimulus	O -(P) > O

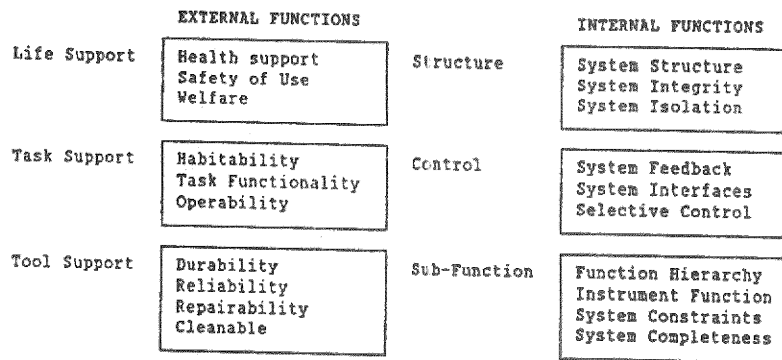
FUNCTION is a PERSON to OBJECT relationship, since persons ascribe functions to objects. AFFECT is an OBJECT to PERSON relationship, since objects have qualities, willy-nilly, that evoke emotions in persons. SYMBOL is a PERSON to PERSON relationship via the OBJECT since meanings are transmitted between persons by objects. ORDER (i.e., visual order) is an OBJECT to OBJECT relationship via the PERSON since objects are perceived in relationship to other objects by means of concepts supplied by the person.

While this is only one possible categorization of the perceptual object, it addresses the main issues within architectural design. It is also comprehensive. Subsequent paragraphs provide a descriptive structure and terminology for these categories.

FUNCTION/PURPOSE IN THE PERCEPTUAL OBJECT (Figure 4.)

A chair must be seen as something to sit in, something safe to sit in, and something that will maintain its "sitability". Figure 4. provides a categorization of external functions, Life Support, Task Support, and Tool Support (or safety, use, and maintenance). These suggest three NIAM Information Structure Diagrams (ISD). The object would require equivalent internal functions to provide these external functions. They are labelled in the diagram, Structure, Control, and Subfunction. The several external categories are drawn from an article by the writer [5], and an NBS publication [6].

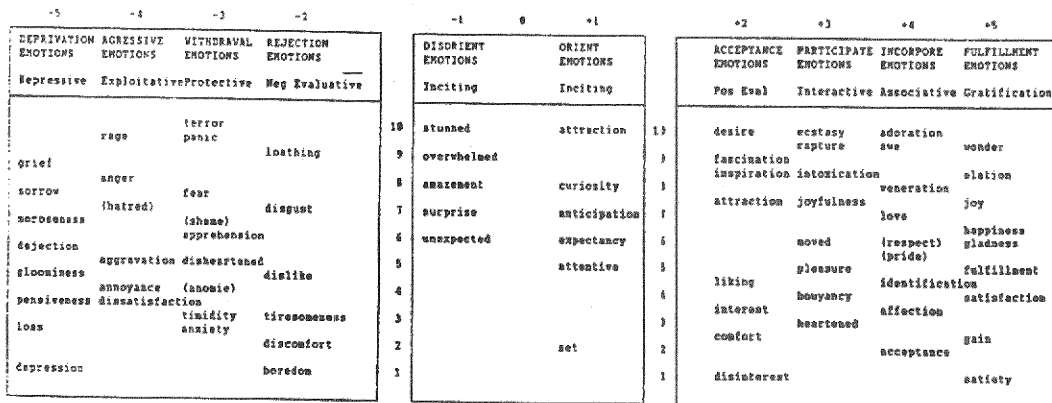
Figure 4.



AFFECT/EMOTION IN THE PERCEPTUAL OBJECT (Figure 5.)

Emotional responses to buildings, whether strong or mild, always exist. Geoffrey Scott's discussion of empathy [9] and Dewey's discussion of emotion in the art experience [10] are both important documents. Thiel's effort to develop a notational system [11], inspired some of the early work on the scheme here. It uses Dewey's movement toward fulfillment as one dimension, and a scale of intensity [12] as the other. While the diagram in Figure 5. indicates a way of

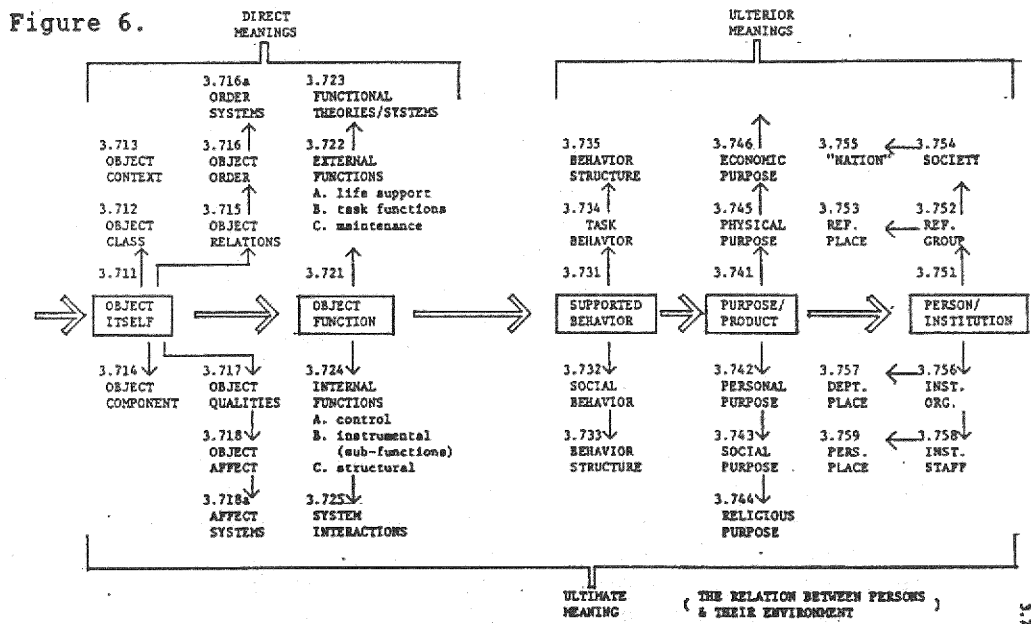
Figure 5.



organizing the range of emotions, referencing those emotions to objects will be more complex. How such emotions are identified and ascribed must take social and cultural responses into account. Its ISD: (object) evokes/is response to (emotion)

**SYMBOL/MEANING IN THE PERCEPTUAL OBJECT (Figure 6.)**

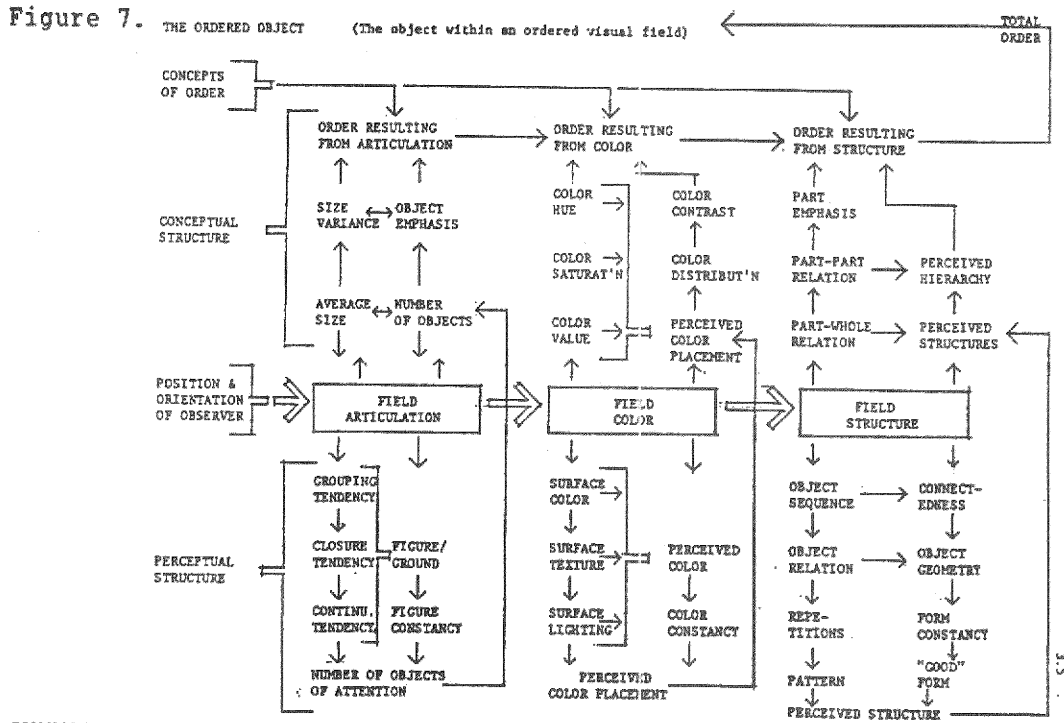
While the increased concern for meaning in architecture came from writers that appeared in the Jenks & Baird volume of 1969 [7], the effort here to categorize building meanings owes more to Eco's use of componential analysis [8]. Figure 6. is taken from a working paper by the writer that uses his PERSON-OBJECT ends-means spectrum as a classification scheme for meanings. (The numbers in the figure refer to explanatory paragraphs in the working paper.) Notice also that Figure 6. groups these meanings into Direct (or self-referential) meanings, Ulterior meanings that can reference users or users' purposes and behaviors, and Ultimate meanings that define the building and building users' relation to the environment. While some of these categories of meaning pertain only to buildings that are high works of art, others are pervasive. Only if a doorway, by its shape and size, means "doorway", does a user know what it is, and how to behave in relation to it. Its ISD: (object) carries/is carried by (meaning)



**ORDER/STIMULUS IN THE PERCEPTUAL OBJECT (Figure 7.)**

Several papers by the writer have discussed the objective component of visual order, by proposing hypotheses and simple mathematical measures based on those hypotheses [13] [16]. In summary, they propose

that order is related to the number of possible subjects of attention in a visual field, and that the number of subjects is related to the articulation of the field, the distribution of color in the field, and the degree of structure in the field. Figure 7. suggests the relation of visual design elements to these measures. This work was assisted by several student projects (e.g., [14]) and was influenced by Moles [15], and by Haralick's image processing work [17] concerned with the measurement of texture. This is an active field of study, but there is a need for experimental work to test the accuracy of the mathematical measures. Since an object's impact on a visual field depends on viewing distance, the ISD might include an object view size to field size ratio. Its ISD: (object) modifies/is modified by (perception of order)



SUMMARY

There was not space in this brief paper, nor time during its hasty preparation to do its subject justice. There are substantial bodies of literature (e.g., in image processing, environmental knowing and evaluation, and semiotics) that should be surveyed more carefully. The relatively modest intent of this paper has been to indicate how the perceptual aspects of objects can be made explicit. Four areas were treated, the function/purpose, symbol/meaning, affect/emotion, and order/stimulus. The writer has asserted that they are a comprehensive set of attributes that can be represented by lexical or mathematical models. He has done so to enlist the interest and participation of colleagues in such a modelling effort. He believes that a way must be found to include person-object relationships in building models.



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