ABSTRACT
        The main import of the present paper is to discuss
what Guttman facet design and analysis is and then to show how this
technique can be used in attitude scale construction. Since Guttman
is best known for his contribution to scaling theory known as
scalogram analysis, a brief historical background is given to
indicate how Guttman moved from a unidimensional approach (scalogram
analysis) to a multidimensional approach (facet design and analysis).
After facet design and analysis is introduced, an example of facet
design is presented in relation to an attitude item paradigm for an
intergroup situation. Some further research using facet design and
analysis is introduced and some elaborations of Guttman's original
formulations are expanded. (Author)

GUTTMAN FACET DESIGN AND

ANALYSIS: A TECHNIQUE FOR

ATTITUDE SCALE CONSTRUCTION

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SOME BACKGROUND HISTORY

Guttman is best known for his contribution to scaling called scalogram analysis. Guttman considered (Guttman, 1950) an attitude area "scalable" if responses to a set of items in that area arranged themselves in certain specified ways. Ideally and theoretically, the items in a Guttman scale are ordered in such a way that all persons who answer a given question favorably have higher ranks than persons who answer the same question unfavorably. It should be possible then, knowing a respondent's rank or scale score, to reproduce that persons responses to each item. This approach to attitude scaling is an unidimensional approach.

Multiple unidimensional scaling is a generalization of Guttman's scalogram analysis, and the method as developed by Lingoes (1963), was entitled Multiple Scalogram Analysis (MSA). This method, like scalogram analysis, deals with dichotomous variables. Unlike scalogram analysis, however, MSA extends Guttman's method to the determination of multiple dimensions instead of the single dimension with which scalogram analysis was concerned.

Guttman entered the multidimensional scaling area with an approach he labelled "facet design and analysis." This technique involved quite a different approach than the empirical method he used in scalogram analysis. Both scalogram analysis and multiple scalogram analysis are techniques for analyzing the responses to items whereas, as will be pointed out, facet design and analysis is a method for constructing items. Since Guttman is best known for his scalogram analysis work this distinction must be made clear. Lingoes (1968) in a summary article indicates the many sorts of computer programs available for all Guttman approaches and the connections that they may have with one another.

LOGIC OF FACET DESIGN AND ANALYSIS

In facet design and analysis, Guttman is concerned with a semantic a priori method of constructing items that has implications for the ensuing structure of the statistical results and their interpretation. The utility of the facet design approach is underlined by Guttman (Guttman & Schlesinger, 1967):

> The facet approach in test construction makes it possible to arrive at items by a systematic a priori design instead of by the usual process of designing test items which is largely based on intuition and on subsequently weeding out inappropriate items by means of statistical analysis of test results (p.3).

A facet is a semantic unit or factor. Guttman (1965) looks at a facet in terms of set theory where a facet is a set containing elements. A Cartesian space can then be made of different facets or sets. Elements are then ordered sub-units of a facet. In diagramming, facets are indicated by capital letters, elements by corresponding small letters with numerical subscripts showing the position of the given element in the order of elements. Foa (1958) states that: "The determiantion of the facets that are relevant to a given class of phenomena involves of necessity a process of selection that is largely intuitive in nature." However, the researcher is of course guided by many principles in selecting the relevant facets. One of these principles, the principle of logical independence of the facets (Foa, 1958) states "that the facets should be such that every combination of their elements describes a phenomenological category that is logically possible."

Facet design permits the principle of contiguity to be invoked, thus providing a method for the interpretation of the structural (established) patterns obtained. Foa states (1958) that conceptual contiguity

is a necessary condition for statistical dependence. Facet design

aims at providing conceptual contiguity that results in statistical

dependence. Guttman and Schlesinger (1966) elaborate on the use of

the contiguity principle in relation to facet design:

> In general, the relationship between items
> within the framework of facet design should
> be expected to have its counterpart in the
> empirically obtained correlation matrix,
> where the size of the correlation is reduced
> to similarity of facet profiles (p.6).

Simply stated, the contiguity principle avers that the correlation

between two variables is higher the more similar their facet structure.

The expected resulting statistical relationship is referred to as

simplex analysis by Guttman. A simplex is not an "approach" or another

name for the contiguity principle but is a particular pattern to be

found in a matrix. A hypothetical example illustrating the simplex

pattern will be presented later.

Besides the facets and their elements, other important concepts

in facet design are: level, level member, and profile. These concepts

will not be elaborated on but will be illustrated in Tables 1 and 2.

AN EXAMPLE OF FACET DESIGN USING
AN ATTITUDE ITEM PARADIGM FOR AN
INTERGROUP SITUATION

Guttman (1950) started by operationally defining an attitude

as "a delimited totality of behavior with respect to something."

Guttman, in later work (1959), proceeded to name the particular facets

and their respective elements that are relevant in an intergroup

situation.

In an analysis of an article written by Bastide and van den Berghe

(1957), Guttman (1959) distinguished three facets involved in a parti-

cular attitude response in respect to intergroup behavior: the (a)

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subject's behavior (a_1 belief or a_2 overt action), the (b) referent (b_1 the subject's group or b_2 the subject _himself_), and (c) the referent's intergroup behavior (c_1 comparative or c_2 interactive). He labelled the first of the two options, or elements, given above in parentheses, of each facet as the "weaker." A particular attitude item, then, was as strong as the number of strong elements (elements with the number 2 subscript) whch appeared.

According to Guttman's rationale, if an attitude item can be distinguished semantically in terms of these three facets, then an individual item could have none, one, two or three strong facets -- a total of four combinations. These combinations are called levels and items are then written to conform to this three-facet, four-level approach. Tables 1 and 2 illustrate the three facets and the names of the levels Guttman associated with them.

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Insert Tables 1 and 2 here

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If items are written to correspond to each of these four levels,
then levels closest to each other should be more similar and thus
should correlate more highly with each other than more distant levels.
Guttman expects this to happen because of the "principle of contiguity"
(Guttman & Schlesinger, 1966). Analysis of this relationship is what
Guttman calls a simplex and Table 3 presents a hypothetical example
using the four levels specified in Table 2. In essence, this approach
implies that if the structure of certain items are close semantically
then they should also be close statistically.

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Insert Table 3 here

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FURTHER RESEARCH
USING FACET DESIGN AND ANALYSIS

Guttman's paradigm for intergroup attitude item construction allows
for three facets and four levels. Theorizing that additional facets were
needed, but accepting the ones that Guttman did identify as appropriate,
Jordan (1968) expanded facet design and analysis for attitude items dealing

with intergroup situations to include five-facets and six-levels.
Jordan designed an attitude instrument toward the mentally retarded
(ABS:MR) that contained the five-facet, six-level structure he hypo-
thesized would appear. Jordan found that preliminary administration
of the instrument yielded results consistent with the researcher's
theory.

Hamersma (1969; 1970) constructed a racial attitude scale using
Jordan's five-facet, six-level extension of Guttman's original paradigm.
This scale was entitled the <u>Attitude Behavior Scale: BW/WN-G.</u> Hamersma's
results were also consistent with the researcher's theory. Other re-
searchers (Dell Orto, 1970; Erb, 1969) have used the <u>Attitude Behavior
Scale: BW/WN-G</u> and have obtained similar results.

Facet design and analysis has also been used to construct in-
struments in other situations not involving attitude research such as:
intelligence tests (Guttman, 1954), dyadic interaction (Foa, 1962),
diagnostic analytical mechanical ability test construction (Guttman &
Schlesinger, 1966), and analysis of the diagnostic effectiveness of a
battery of achievement and analytical ability tests (Guttman & Schlesinger,
1967).

<div align="center">SUMMARY</div>

Most attitude scales in the past have been heavily loaded with
stereotypic items. These have usually been constructed using a conglomera-
tion of techniques thus making most research not directly comparable.
Facet design and analysis is a technique presented by Guttman that would
allow the researcher to construct a scale by a semantic, logical, <u>a priori</u>
method and enable the researcher to predict the statistical order structure

which would result from empirical observation. Scales have already

been constructed using a facetized design (Guttman, 1959; 1966; 1967;

Hamersma, 1969; 1970; Jordan, 1968).

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TABLE 1

Three Facets and Their Corresponding Elements
Contained in the Semantic Structure of an Attitude Item

	A	B	C
Facets	Subject's Behavior	Referent	Referent's Intergroup Behavior
Elements	a_1 belief	b_2 subject's group	c_1 comparative
	a_2 overt action	b_2 subject himself	c_2 interactive

TABLE 2

Profiles and Descriptive Labels Associated
with Four Levels or Types of Attitudes Items

Level	Profile	Descriptive Label
1	$a_1b_1c_1$	Stereotype
2	$a_1b_1c_2$	Norm
3	$a_1b_2c_2$	Hypothetical Interaction
4	$a_2b_2c_2$	Personal Interaction

Note: - There are 8 possible profiles or levels but
Guttman selected four as making the best logical
sense, i.e., some permutations are not logically
consistent. Maierle (1969) presents an elaborate
analysis of the principles leading to logical
permutations.

TABLE 3

Hypothetical Matrix of Level-by-Level
Correlations Illustrating the Simplex Structure

Level	1	2	3	4
1	---			
2	.60	---		
3	.50	.60	---	
4	.40	.50	.60	---

Note: - One does not attempt to predict the magni-
tudes of each correlation coefficient. The
simplex requirements do not necessitate either
identical mathematical differences among
various correlations or identical correlations
between sets or adjacent levels, so that the
bottom row of the matrix reading from left to
right could contain such figures as .10, .32,
and .49.