The main definitions from representative measurement theory are reviewed in this section. A relational structure A consists of a set A and relations $S_1,\ldots,S_n$ defined on A

$A = <A,S_1,\ldots,S_n>$.

Each relation S_i is a Boolean function (predicate) with n_i arguments from A. The relational structure $A = <A,S_1,\ldots,S_n>$ is considered along with a relational structure of the same type

$R = <R,T_1,\ldots,T_n>$.

Usually the set R is a subset of Re^m, $m \geq 1$, where Re^m is a set of m-tuples of real numbers and each relation T_i has the same n_i as the corresponding relation S_i. T_i and S_i are called a k-ary relation on R. Theoretically, it is not a formal requirement that R be numerical.

Next, the relational system A is interpreted as an empirical real-world system and R is interpreted as a numerical system designed as a numerical representation of A. To formalize the idea of numeric representation, we define a homomorphism φ as a mapping from A to R.

A mapping $\varphi: A \rightarrow R$ is called a homomorphism if for all i (i = 1,…,n),

$$(a_1,\ldots,a_{k(i)}) \in S_i \iff (\varphi(a_1),\ldots,\varphi(a_{k(i)})) \in T_i.$$

In other notation,

$$S_i(a_1,\ldots,a_{k(i)}) \Leftrightarrow T_i(\varphi(a_1),\ldots,\varphi(a_{k(i)})).$$

Let Φ(A,R) be the set of all homomorphisms for A and R. It is possible that Φ(A,R) is empty or contains a variety of representations. Several theorems are proved in RMT about the contents of Φ(A,R). These theorems involve: (1) whether Φ(A,R) is empty, and (2) the size of Φ(A,R). The first theorems are called representation theorems. The second theorems are called uniqueness theorems.

Using the set of homomorphisms Φ(A,R) we can define the notion of permissible transformations and the data type (scale types). The most natural concept of permissible transformations is a mapping of the numerical set R into itself, which should bring a "good" representation. More precisely, γ is permissible for Φ(A,R) if γ maps R into itself, and for every φ in Φ(A,R), γφ is also in Φ(A,R). For instance, the permissible transformations could be transformations, $x \rightarrow rx$ or monotone transformations $x \rightarrow \gamma(x)$.