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Nominal Scale

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A nominal scale is a scale of measurement used to assign events or objects into discrete categories. This form of scale does not require the use of numeric values or categories ranked by class, but simply unique identifiers to label each distinct category. Often regarded as the most basic form of measurement, nominal scales are used to categorize and analyze data in many disciplines. Historically identified through the work of psychophysicist Stanley Stevens, use of this scale has shaped research design and continues to impact on current research practice. This entry presents key concepts, Stevens's hierarchy of measurement scales, and an example demonstrating the properties of the nominal scale.

Key Concepts

The nominal scale, which is often referred to as the unordered categorical or discrete scale, is used to assign individual datum into categories. Categories in the nominal scale are mutually exclusive and collectively exhaustive. They are mutually exclusive because the same label is not assigned to different categories and different labels are not assigned to events or objects of the same category. Categories in the nominal scale are collectively exhaustive because they encompass the full range of possible observations so that each event or object can be categorized. The nominal scale holds two additional properties. The first property is that all categories are equal. Unlike in other scales, such as ordinal, interval, or ratio scales, categories in the nominal scale are not ranked. Each category has a unique identifier, which might or might not be numeric, which simply acts as a label to distinguish categories. The second property is that the nominal scale is invariant under any transformation or operation that preserves the relationship between individuals and their identifiers.

Some of the most common types of nominal scales used in research include sex (male/female), marital status (married or common-law/widowed/divorced/never-married), town of residence, and questions requiring binary responses (yes/no).

Stevens's Hierarchy

In the mid-1940s, Harvard psychophysicist Stanley Stevens wrote the influential article "On **[p. 903 ↓]** the Theory of Scales of Measurement," published in *Science* in 1946. In this article, Stevens described a hierarchy of measurement scales that includes nominal, ordinal, interval, and ratio scales. Based on basic empirical operations, mathematical group structure, and statistical procedures deemed permissible, this hierarchy has been used in textbooks worldwide and continues to shape statistical reasoning used to guide the design of statistical software packages today.

Under Stevens's hierarchy, the primary, and arguably only, use for nominal scales is to determine equality, that is, to determine whether the object of interest falls into the category of interest by possessing the properties identified for that category. Stevens argued that no other determinations were permissible, whereas others argued that even though other determinations were permissible, they would, in effect, be meaningless. A less argued property of the nominal scale is that it is invariant under any transformation. When taking attendance in a classroom, for example, those in attendance might be assigned 1, whereas those who are absent might be assigned 2. This nominal scale could be replaced by another nominal scale, where "1" is replaced by the label "present" and "2" is replaced by the label "absent." The transformation is considered invariant because the identity of each individual is preserved. Given the limited determinations deemed permissible, Stevens proposed a restriction on analysis for nominal scales. Only basic statistics are deemed permissible or meaningful for the nominal scale, including frequency, mode as the sole measure of central tendency, and contingency correlation. Despite much criticism during the past 50 years, statistical software developed during the past decade has sustained the use of Stevens's terminology and permissibility in its architecture.

Example: Attendance in the Classroom

Again, attendance in the classroom can serve as an example to demonstrate some properties of the nominal scale. After taking attendance, the information has been recorded in the class list as illustrated in Table 1.

Student ID	Arrives by School Bus	Attendance on May 1
001	Yes	Absent
002	Yes	Absent
003	Yes	Present
004	Yes	Absent
005	Yes	Absent
006	Yes	Absent
007	Yes	Absent
008	Yes	Absent
009	Yes	Absent
010	No	Present
011	No	Present
012	No	Present
013	No	Present
014	No	Absent
015	No	Present

The header row denotes the names of the variable to be categorized and each row contains an individual student record. Student 001, for example, uses the school bus and is absent on the day in question. An appropriate nominal scale to categorize class attendance would involve two categories: absent or present. Note that these categories are mutually exclusive (a student cannot be both present and absent), collectively exhaustive (the categories cover all possible observations), and each is equal in value.

Permissible statistics for the attendance variable would include frequency, mode, and contingency correlation. Using the previously provided class list, the frequency of those present is 6 and those absent is 9. The mode, or the most common observation, is "absent." Contingency tables could be constructed to answer questions about the population. If, for example, a contingency table was used

Table 2 Contingency Table for Attendance and Arrives by School Bus

		Attendance		
		Absent	*Present*	*Total*
Arrives by school bus	Yes	8	1	9
	No	1	5	6
Total		9	6	15

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to classify students using the two variables attendance and arrives by school bus, then Table 2 could be constructed.

The results of the Fisher's exact test for contingency table analysis show that those who arrive by school bus were significantly more likely to be absent than those who arrive by some other means. One might then conclude that the school bus was late.

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See also

Further Readings

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