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(iii) Managing communication

# ASSESSING THE QUALITY OF COMMUNICATION IN STATISTICS: THE APPLICATION OF A MODEL

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## I. THE CONCEPTUAL MODEL

1. Evaluating and assessing communication in statistics should be accomplished by evaluating the level of **general noise**. Any assessment is intimately connected to the possibility to verify and control what has to be assessed. In the ambit of communicating statistics, defining and identifying the following aspects allow the assessing task to be carried out:

a. **The dimensions to evaluate.** In our perspective, the assessment (and the consequent adjustment and/or adaptation) concerns the transmitters and their codes. In this context, we will concentrate our attention on the transmitter's code, specified in terms of (i) outline, (ii) tools, and (iii) clothes.

b. **The evaluating criteria.** Criteria are related to the (a) *appropriateness*, (b) *correctness*, and (c) *clarity* of the code according to the components of the transmission process. The criteria refer to the capacity of the transmitter in using the code.

c. **The components of the transmission process.** The dimensions should be evaluated through the defined criteria with references to the components of the transmission process: (i) the receiver/audience (and its receiving code), (ii) the available channel, and (iii) the available context and setting, and, in some way, (iv) the contents message.

### A. The dimensions to evaluate: the codes

2. It refers to the "technological" apparatus allowing communication. The apparatus has its grammatical, syntactical and stylist rules that, in statistical communication, refer to (i) the way statistics are reported (outline), (ii) the tools used in order to transmit statistics (tools), and (iii) the way in which statistics are dressed (clothes).

#### Telling statistics: the outline

3. "Outline" refers to the process of telling statistics. It can be brought back to five steps:

a. ***Inventio* (invention) allows arguments to be argued**. The topics should be able to point out the relevant, positive, or pleasant aspects, by overshadowing and leaving out others considered irrelevant, negative, or unpleasant. In order to organize the topics to be presented, it is possible to refer to the well-known 5 W: (1) *Who* (the subject of the telling), (2) *What* (the fact), (3) *When* (the time location), (4) *Where* (the field location), (5) *Why* (the causes). Sometimes, we can add also "in which way" and "by which means."

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b. ***Dispositio* (layout)** allows the previously identified **topics to be put in order** for presentation. The sequence of presentation should follow a logical order, appropriate to topics we are presenting and to the results we would obtain. Organizing the argument into a logical tissue should take into account that the organized combination of several yarns allows a woof to be obtained which is more resistant than their mere sum (Perelman, 2005). Different layout approaches can be identified, such as: deductive, inductive, time-progression, problems-related, advantages-disadvantages, from-points-of-view, top-down approaches. Obviously, each of the different layout approaches has pros and cons and is more or less suited to different situations and audiences. The choice should take into account expected objectives, kinds of argument, audiences, and, last but not least, presenter's preferences.

c. ***Elocutio* (expression)** allows **each piece of the presentation to be prepared by selecting words and constructing sentences**. This task is strictly related to rhetoric. One of the most important choices to be taken concerns the title of the presentation: except for the cases in which rules and procedures exist, the title should be prepared according to an explicative idea. Even if rhetoric figures are used with care, we should take into account that rhetoric is an integral part of language in which almost all is metaphor (Lakoff, 1980), it seems quite impossible to reduce language to an aseptic form, without a reference code. The language adopted in communicating statistics should be (i) appropriate to the audience, (ii) consistent with the message to be transmitted. Besides, in telling statistics, special attention should be paid to (a) wording (choice of proper words to be used), (b) languages (use of specialist terminologies), (c) tongues (use of languages in international contexts)

d. ***Actio* (execution)** concerns the way in which the telling, in terms of (i) introduction, (ii) development, (iii) comments, (iv) time/space use, (v) ending, and the receivers' feedback (*questions & answers* stage) is managed.

e. The outline can not be developed through a linear progression but through a cyclic process allowing previous steps to be run through again in order to check, improve, correct, integrate, and review before reaching the "action" stage.

**Depicting statistics: the tools**

4. "Tools" refer to all available instruments aimed at depicting statistics, by constructing and using graphs, tables, and pictographic supports. Graphical representations may have a double function, presenting and describing results and allowing a quick and synthetic interpretation of the observed phenomenon and its trends. In this perspective, statistical graphics should be considered as a good combination of text, tables and charts (Statistics Canada, 2003). Even if a clear limit between advantages and disadvantage in using graphs does not exist, general guidelines can be identified helping in determining the best strategies in depicting statistical information. The goal is to make sure to preserve the graph's capacity to autonomously communicate the message.

**Dressing statistics: the clothes**

5. "Clothes" refer to the process of dressing statistics. Communicating statistics should be supported also by other elements:

- text arrangement, which should be related to the disposition of the text on the used mean (slide, page)
- characters and fonts, which should be consistent with the spirit and character of the presentation
- colours, which should take into account their perception, possible cultural meanings and used means. Colours in graphs represent a further code element
- other graphical aspects and effect (photos, clipart).

## B. The evaluating criteria

6. The criteria refer to the transmitter's ability to use the code in terms of (A) appropriateness (in terms of pertinence), (B) correctness (in terms of accuracy) and (C) clarity. From the theoretical point of view, each criterion could define a continuum, from minimum to maximum level. The conceptual continuum must be scaled in order to make it applicable. Subsequently, the continuum transformed into an interpretable scale must be standardized by examining if the defined scale (i) meets and respects the underlying concept (consistency), (ii) is applicable through clear and easy rules, (iii) is usable by different individuals by obtaining comparable results. However, in this first stage of the study, attempts aimed at making operative the criteria's concepts and standardizing them into an applicable scale encountered many difficulties. Consequently, the final decision converged to simply binary scaling solution:

| DEFINED SCALE: | | |
|---|---|---|
| **POLARITY** | **LABELS** | **SCORES** |
| **Bipolar** | **No** | **0** |
| | **Yes** | **1** |

Table 1. Definition of the applied scale

## C. The components of the transmission process

7. **Audience (the receiver).** In communicating statistics, we could refer to receivers in terms of "audience." In general, receivers of statistical communication can be represented by (a) experts, (b) politicians and policy makers, (c) statistical data users, (d) not specialized users. Another well-know definition (Vale, 2008) distinguishes between a) *tourists*, b) *harvesters*, c) *miners*.

8. **Channel.** The channel represents the transmissive mean through which the message reaches the receiver. In communicating statistics, we can identify the auditory channel ("listening"), the visual channel ("looking"), and – when applicable – the kinetic channel ("doing").

9. **Context.** It refers to the situation or occasion in which the communication is accomplished. With reference to communicating statistics, we can identify different contexts, like seminars, conferences, meetings, press conferences, books, booklets, and so on. Each context has its own **setting** (papers, tables, etc.). Evaluating the outline, the tools and the clothes with reference to the context should take into account if the context allows for **feedbacks**.

10. **Topic** and **data (message).** In communicating statistics, the message is represented by statistics (data, comments on data, and so on).

11. **Noise.** It is represented by whatever element is disturbing the communication process. Noises could be identified in each of the previous elements. The goal is to reduce or eliminate its presence and effect.

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12. At this point, the assessment model can be summarized in the following way:

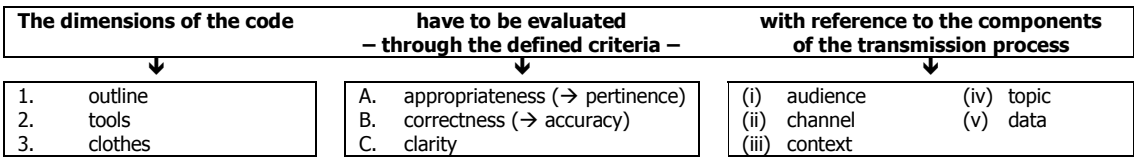


Figure 1. The assessment model

## II. THE APPLICATION

### A. The assessing table

13. The conceptual model can be consistently assessed by developing an *Assessing Table I*:

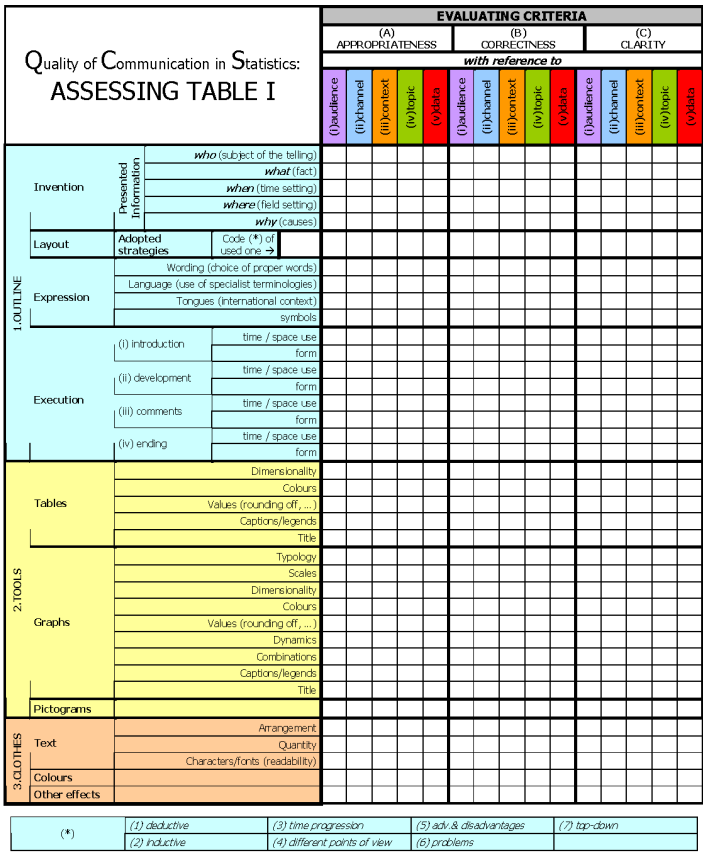


Figure 2. The assessing table (I)

### B. Study planning and data collection

14. Since our main goal was to assess the proposed model, the judges have been selected by taking into account their competence in survey methodology and statistical issues. Each judge was asked to evaluate the presence (1) or absence (0):

- of the criterion → A) appropriateness, B) correctness, C) clarity
- in each code → 1. outline, 2. tools, 3. clothes
- with reference to → (i) audience, (ii) channel, (iii) context, (iv) topic, and (v) data

in the following publications (collected at the UNECE Work Session on the Communication and Dissemination of Statistics held in Warsaw, Poland on 13-15 May 2009):

1. Central Statistical Office (2009) *Poland in the European Union*, Central Statistical Office, Warsaw.
2. Eurostat (2008) Statistical Portrait of the European Union – European Year of Intercultural Dialogue, Eurostat, Statistical Books, Luxembourg.
3. Federal Statistical Office (2009) *Statistical Data on Switzerland*, Federal Statistical Office, NeuChâtel, Switzerland.
4. Kazakhstan Statistics (2008) *The Statistical Guidebook*, Agency of the Republic of Kazakhstan on Statistics (Astana).

5. ISTAT (2009) *Italy in Figures*, Rome, Italy
6. United Nations – Economic Commission for Europe (2009) *UNECE. Countries in Figures*, United Nations, New York – Geneva.

15. Actually, the *assessing table I* guided each judge to express a comprehensive evaluation of each publication. Subsequently, each judge was asked to reduce (by applying the modal criterion) the comprehensive evaluation by condensing the scores assigned to code for each criterion (Appropriateness, Correctness and Clarity) by filling a second assesing table:

| Quality of Communication in Statistics: ASSESSING TABLE II | | EVALUATING CRITERIA | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | (A) APPROPRIATENESS | | | | | (B) CORRECTNESS | | | | | (C) CLARITY | | | |
| | | *with reference to* | | | | | | | | | | | | | |
| | | (i)audience | (ii)channel | (iii)context | (iv)topic | (v)data | (i)audience | (ii)channel | (iii)context | (iv)topic | (v)data | (i)audience | (ii)channel | (iii)context | (iv)topic | (v)data |
| 1. OUTLINE | a. Invention | | | | | | | | | | | | | | |
| | b. Layout | | | | | | | | | | | | | | |
| | c. Expression | | | | | | | | | | | | | | |
| | d. Execution | | | | | | | | | | | | | | |
| 2. TOOLS | a. Tables | | | | | | | | | | | | | | |
| | b. Graphs | | | | | | | | | | | | | | |
| | c. Pictograms | | | | | | | | | | | | | | |
| 3. CLOTHES | | | | | | | | | | | | | | | |

Figure 3. The assessing table (II)

16. Each row in the data matrix reports the subjective binary scores for each row of assessing table II for each criterion. The matrix rows are nested by (a) components of the transmission process (5 levels), (b) publications (seven levels), (c) judge (5 levels).

## C. Data analysis

17. The evaluation model described in the previous paragraphs involves the assessment of each statistical publication against several binary (and, more possibly, ordinal) dimensions. The problem now arises of how to combine the evaluations on each quality dimension into a final quality assessment. To tackle this issue, we propose a fuzzy approach based on the use of partial order theory, with the aim of computing quality assessments respecting the ordinal nature of the data.

18. Consistently with the methodological aims of this paper, we limit ourselves to illustrating the methodology of analysis, through a simple example, pertaining the outline quality of six official publications, coming from Eurostat, Italy, Kazakhstan, Poland, Switzerland and UNECE.

19. In a fuzzy perspective, each publication p is assigned a degree of quality q(p) in the range [0,1]. If q(p) = 1, then p certainly belongs to the set of "good quality" publications; on the contrary, if q(p) = 0, then p certainly belongs to the set of "bad quality" publications. In practice, q(p) can be interpreted as a measure of the quality degree of publication p. In order to compute q(p) for each publication, quality data are first represented as a partially ordered set, as briefly explained below; next partial order tools are applied so as to extract the information pertaining to the quality assessment.

20. Let us consider the four binary quality dimensions (*Invention*, *Layout*, *Expression* and *Execution*) relative to the outlines of six official publications $P_1,\ldots,P_6$, pertaining to audience appropriateness and audience clarity (Tables 2 and 3). For sake of simplicity, consider appropriateness data first. Quite naturally, we can say that publication $P_i$ has a degree of outline appropriateness greater than publication $P_j$ (in formulas, $P_j < P_i$) if its scores on all four appropriateness dimensions are not lower than those of $P_j$, and there is at least one dimension where $P_i$ scores better than $P_j$. In all other cases, we say that publications $P_i$ and $P_j$ are incomparable. As a result, publications can be ordered only in a partial way and give rise to a partially ordered set, or a *poset* for short (note that if two publications have the same set of scores, they are treated as a single element in the poset). Similar considerations hold for clarity. Each sequence of four binary scores on the quality dimensions of concern defines a *quality configuration* or *quality state*. Since four binary variables are considered, there are 16 possible quality states, that can be partially ordered according to the criterion introduced above. The poset Q of quality states is depicted in Figure 4, in terms of so-called Hasse diagrams. Each node in the diagrams represents a different quality state. If s < t in Q, then node s is placed below node

t. An edge is placed connecting node t to node s if and only if s < t and there is no other state z such that s < z < t. Black nodes represent quality states actually occupied by publications in our sample.

| | Audience appropriateness | | | | Audience clarity | | | |
|---|---|---|---|---|---|---|---|---|
| Publication | Invention | Layout | Expression | Execution | Invention | Layout | Expression | Execution |
| $P_1$ | 1 | 1 | 0 | 0 | 1 | 1 | 0 | 1 |
| $P_2$ | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| $P_3$ | 0 | 1 | 1 | 1 | 0 | 1 | 1 | 1 |
| $P_4$ | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| $P_5$ | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| $P_6$ | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |

Table 2. Data about audience appropriateness and audience clarity for the outlines of six official publications

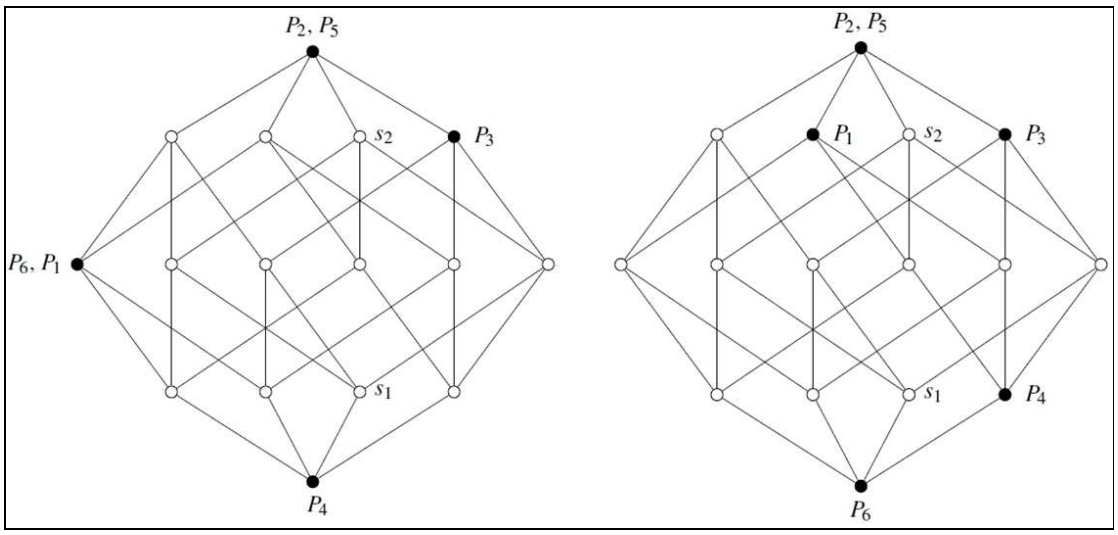


Figure 4. Hasse diagrams of quality configurations pertaining to audience appropriateness (left) and audience clarity (right) for the publication outlines

21. A direct inspection of the diagrams shows that:

1. $P_2$ and $P_5$ occupy the top position in both diagrams;
2. $P_1$, $P_6$ are incomparable with $P_3$, relative to audience appropriateness, but all of them are better ranked than $P_4$;
3. $P_1$ and $P_3$ are incomparable in terms of audience clarity, but both dominates $P_4$ and $P_6$, which occupies the bottom node.

22. Now, suppose two elements $s_1$ and $s_2$ ($s_1 < s_2$) are identified in Q, representing a bad quality configuration and a good quality configuration respectively. In our example, $s_1 = 0010$ and $s_2 = 1011$ have been chosen, for both appropriateness and clarity (in this example, the choice has a pure illustrative aim.). By definition, $q(s_1)=0$ and $q(s_2)=1$. Moreover, if $t < s_1$, then $q(t)=0$; conversely, if $s_2 < z$, then $q(z) = 1$. In other words, all the states below $s_1$ are classified as bad quality and all the states above $s_2$ are classified as good quality (hence, $s_1$ and $s_2$ can be regarded as the bad quality threshold and the good quality threshold,). But what about states that are incomparable with $s_1$ or $s_2$? Here the analysis of the partial order structure of Q comes into play.

23. The analysis of the partial order structure is performed considering a different representation of the partial order relation, in terms of linear orderings. A linear ordering of the elements of Q not violating the original partial order is called a linear extension of Q. The set W(Q) of all the linear extensions of Q characterizes uniquely the partial order, so that considering W(Q) is the same as considering Q. The incomparability between a state t and $s_1$ (resp. $s_2$) reflects in that some linear extensions rank t below $s_1$ (resp. $s_2$), while others rank t above $s_1$ (resp. $s_2$). The higher the number of linear extensions ranking t below $s_1$, the more "strongly" t can be considered as bad quality, even if in the original poset t and $s_1$ are incomparable. Similarly, the higher the number of linear extensions ranking t above $s_2$, the more "strongly" t can be

considered as good quality. In other words, linear extensions can be regarded as "judges" ranking each poset state as bad quality or good quality. The final quality degrees can thus be obtained based on the frequencies each publication is ranked as bad quality or good quality (Fattore et al., 2009). For the publications considered in our example, results are reported in Table 3 and are represented in the scatter plot of Figure 5.

| Publication | Audience appropriateness | Audience clarity |
|---|---|---|
| $P_1$ | 0.6 | 0.6 |
| $P_2$ | 1.0 | 1.0 |
| $P_3$ | 0.9 | 0.9 |
| $P_4$ | 0.0 | 0.2 |
| $P_5$ | 1.0 | 1.0 |
| $P_6$ | 0.6 | 0.0 |

Table 3. Quality degrees for outline audience appropriateness and outline audience clarity

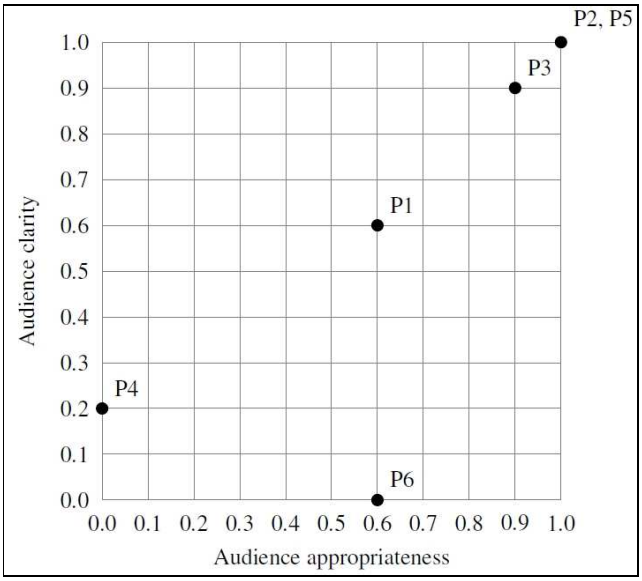


Figure 5. Scatter plot for outline quality

24. Publications *P2* and *P5* get the best possible scores, since they occupy the top position in both Hasse diagrams. All other publications get intermediate scores, as a result of their "ambiguous" position in the posets.

## III. COMMENTS

25. The application shows how the procedure (assessing table, data collection and POSET data analysis) reaches meaningful and interpretable results allowing the different publications to be compared and ranked with reference to the evaluation criteria.

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