Quality control procedures in a meter panel.

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A TV meter panel operation, while conceptually simple, involves a relatively complex series of aspects that must be considered jointly in order to assess its quality rigorously. The first part of this paper sets out those elements to consider in what we could call a model for analysing the quality of a meter panel. In the second part, we shall look at what we call statistical inspection, which focuses on the detection of anomalous viewing situations and their subsequent investigation including, if required, the application of corrective measures.

Elements of a quality analysis model in a meter panel.

First, let's break down the meter panel operation into its different facets in order to determine the critical elements to be studied.

Universe

Those activities aimed at determining and quantifying the universe under study are included under this heading. Said universe normally corresponds to the individuals residing in households with television sets that are located in a given geographical area.

- The universe under study must be clearly delimited and documented. The documentation will contain the characteristics and/or exclusions of the universe in terms of

  - ✓ Geographical zone.
  - ✓ Age intervals encompassed.
  - ✓ Types of households/dwellings. For example, collective dwellings are excluded –residences, hospitals, military barracks, convents, etc.- along with second homes, etc.
  - ✓ Limitations, if there are any, with regard to the equipment level, nationality, race, religion, etc.

- Additionally, the universe quantification process must also be documented, broken down into the variables that are of interest to the study design. The sources used and details of the desk research carried out must also be indicated.

  This information usually originates from two types of sources:

  - ✓ Censuses and official statistics (quantification of the population by sex, age, region, habitat, family size, number of households, etc.).
  - ✓ Other research, normally carried out using sampling procedures (television equipment, socio-economic classification, etc.).

Sample design

Let's consider four main elements:

- Distribution of the sample. Type of allocation.
- Sampling frame used (addresses from a prior establishment survey, list of streets, electoral districts, etc.).
- Selection of panellist households. Rules and procedures for selecting households.
- Calculation of the expansion factors. Details of the cell / rim weighting procedure.
- Households ineligible for selection (for example, those without telephones, with an specified type /brand of television set, etc.).

Coverage

- Treatment of guests.
- Television sets not covered (rule of exclusion: those under a certain size, only a certain maximum number of sets are monitored per home, etc.).
- Television behaviour not covered, if any: watching TV channels through the VCR, viewing of videotapes, etc.

Panellists

- Collaboration remuneration system: points, cash payments, etc.
- Instructions to the panellists (documentation).
- Contract or agreement of collaboration.
- Members of the household, visitors, guests, etc. (operating definitions).

Building and maintenance of the panel

- Information collected on the households (questionnaire).
- Control of the response rate.
- Breakdowns and other temporary dropouts: frequency, length and causes of these.
- Control of panel stability
  - ✓ Panel rotation criteria.
  - ✓ Analysis of enrolments and dropouts. Dropout reasons.
  - ✓ Evolution of the usable (in-tab) sample and analysis of daily sample reduction (communications, exclusion for validation, temporary dropouts, etc.)
- Analysis of the installed sample. Comparison with the theoretical sample. Seniority, geographical dispersion, etc.
- System for updating the characteristics of the panel households.
- Television sets not monitored in panel homes (due to the application of exclusion rules or because of other reasons).

Meter panels

- Technological capacity
  - ✓ Maximum number of household members and guests.
  - ✓ Channel/TV network recognition system.
  - ✓ Precision in time of the viewing records (persistence, etc.).

  - ✓ Behaviour when confronted with different input sources: video, satellite, etc.
  - ✓ Programme appreciation capabilities.
  - ✓ Other characteristics: teletext detection, etc.
- Content and structure of the records stored.

Data processing

- Processing of the viewing records
  - ✓ Assignment of TV channels.
  - ✓ Assignment of individuals (the remote control button may not directly identify the individual throughout the time period since changes in the structure of the household make it necessary to reassign buttons).
  - ✓ Treatment of meter power failures.
  - ✓ Resolution of duplicated viewing (a single individual is simultaneously registered as viewer in two or more television sets).
  - ✓ Reduction of the information recorded in seconds to the level of minutes. Rules for the minute attribution.
- Calculation of expansion factors
- Automatic validation. Partial or total elimination of sample households / viewing records according to predetermined rules. The following are cases that could be subject to some type of elimination:
  - ✓ Invalid channels.
  - ✓ Uncovered viewing (TV set on but no registered viewers).
  - ✓ Excessive number of records (suspected meter trouble).
  - ✓ System and meter time not synchronised.
  - ✓ Extreme viewing behaviour (for example, more than 15 hours watching the same network without interruption).
  - ✓ Etc.
- Aggregation and projection (both in the production software as well as in that used in user PC's).
- Estimation of audience indicators. Definitions and algorithms.
- Information on the process, produced regularly by the system. For example:
  - ✓ Installed and usable sample. Analysis of the differences.
  - ✓ Degree of inefficiency introduced by the rim weighting procedure balancing. Effective sample size.
  - ✓ Statistics on invalid channels and uncovered viewing.
  - ✓ Report on validation actions.
  - ✓ Etc.
- Calculation precision.

Broadcasting logs

- Operating rules (documentation). Classification of the events.
- Content and a structure of the records.
- Statistics on errors: by error type, by phase in which they are detected, etc.

Service follow-up

- Statistics on service indicators.

User software (PC)

- Data compression.
- Calculation speed.
- Ease of learning and use.
- Stability.
- Documentation.
- Range of analyses performed.

Additional elements for controlling the quality of the measurement operation.

- Internal coincidental studies.
- Comparisons with other sources:
  - ✓ External coincidental surveys.
  - ✓ Others.
- Interviews to ex-panellists.
- Etc.

General

- Level of documentation on the operation.
- Service level
  - ✓ Speed of delivery of reports and/or files.
  - ✓ Technical and statistical support to the user.
- Methodological transparency.
- Industry control: Users Committee, external auditing, etc.

Statistical inspection

Included here are the full set of activities aimed at detecting anomalous viewing behaviours and situations. We shall first list a series of controls that are normally used to detect problems in the network viewing tables, in panellist discipline and other operational aspects.

- Households that do not receive a channel that is seen in homes in the same geographical area. Similar cases.
- Television sets that apparently do not pick up a channel that can be viewed on another set in the same household.
- Analysis of power supply failures in the meters. Were these general power failures or was the meter disconnected?.
- A TV network is not watched at all (over a sufficiently long period of time), when records show that it can be watched. Monitoring in relation to the household and to each single television set.
- A TV set is not switched on during a sufficiently long period of time.
- Correspondence between frequencies and channels. Control of the consistency among devices (VCR's or TV sets) in the same household and also among the households of the same geographical zone.

- The same frequency is associated to different networks in a single household (in different sets). The same network is associated to more than one frequency in the same household (possible reception from different retransmitters).
- Lack of panellist discipline.
  - ✓ Homes that frequently show cases of uncovered viewing (TV sets on but with no viewers).
  - ✓ Homes that frequently show cases of duplicated viewing (the same individual registered as viewer in more than one TV set at the same time).

Atypical viewing behaviours

Extreme or atypical behaviour found in meter panel records owe to diverse causes:

- An actual extreme behaviour registered by the meter. When these cases are investigated, an explanation for the extreme behaviour is often found, for example:

  - ✓ Very high viewing time and share is detected for foreign channels: Reason: Household members are foreigners residing in Spain.
  - ✓ Very high viewing time of television is detected. Reason: One of the members of the household is ill, confined to bed and keeps the TV on at all times.

  Unfortunately, in many other cases, the investigation does not lead to such conclusive results. When one attempts to delve further into why an individual or household has a special “liking” for a certain network, in a good number of cases the only thing achieved is that the household confirms this “liking” with comments meant to justify it but not solid enough to remove all doubts. It must be kept in mind that queries made of the household must be prudent and respectful of opinions and behaviours (“interrogatory” techniques cannot be used). This necessarily restricts the possibility of obtaining conclusive responses.

- A registered extreme behaviour that does not correspond to actual viewing behaviour. Caused by a lack of discipline on the part of the panellist in the fulfilment of his obligations. This may be due to any of the following reasons:

  - ✓ Deliberate falsification of actual TV viewing behaviour. A classic example is the response of panellist to what have been called “perturbing actions”, requests – explicit or implicit, conscious or not– by the media to panellists requesting their collaboration in achieving high audience shares. The most notable case in Spain occurred in October 1994 when a TV network announced that it would help pay the cost of an surgical operation needed by a boy with leukaemia by contributing a sum of money proportional to the audience level obtained during the broadcasted football match. The audience figures given by the meters were extremely and artificially high. A solidarity feeling made the panel members to push all the meter buttons to help the poor sick child.

  - ✓ Other, non-deliberate faults: forgetfulness, lack of willpower to carry out the instructions received, etc. The case of a person who falls asleep in front of the TV and does not wake up until the next morning and similar cases would also be included under this heading, although here we cannot properly speak of "guilty" behaviour on the part of the panellist.

Procedures for detecting extreme behaviours

The general philosophy of statistical inspection is based on the general considerations of sampling theory. We are making inferences about a group using a sample. If the dispersion (measured by the sample variance or any other type of dispersion indicator) is high because one observation is notably different from the rest, we can suppose that said observation is erroneous –in more strict terms, there is a high probability that it is erroneous– and therefore its elimination or adjustment is justified. The procedure to adopt can be supported more rigorously if it a given statistical distribution is presumed in the population (normal, log-normal, etc.); in practice, however, this theoretical backing is not strictly necessary to obtain the desired results.

Two basic approaches are possible in a panel:

- Comparison of the data of a sample element during a time interval with the same data for the other sample elements within the same period of time.

- Comparison of the data of an element of the sample in the time period with the same data for the same sample unit during a previous period (trend inspection).

For now, and in our application to the meter panel, we shall concentrate on the first approach. In general, individual observations are understood to be those of an element of the panel (individual or household) in relation to a TV channel (total television, like any other possible aggregation of channels is considered one more channel). Three basic analysis alternatives can be envisaged for a given period (program, day-part, day, week, month, etc.):

- Extreme TV consumption.

- Extreme individual shares. Here we are referring to the share of one network/channel in the total viewing time of television of an individual or household. This is what in AIMC we have called "extreme affinity". We have also used the more graphic terms of "philias" and "phobias" to refer to these types of phenomena.

- Extreme contribution. Here the data to analyse for each individual/channel observation is its importance with relation to the total viewing of the channel. To be rigorous, the comparison should be done with the expanded data, although if the disproportionality of the sample is not very high, an approximation can be made using unexpanded data.

If we call the observations y_{ij} (viewing time in minutes of channel "j" by individual "i"), we can say that the analysis focuses, in each of the cases, on the following distributions:

- Extreme viewing time: $\{y_{ij}\}$
- Extreme affinity: $\left\{\dfrac{y_{ij}}{\sum_j y_{ij}}\right\}$
- Extreme contribution: $\left\{\dfrac{y_{ij}}{\sum_i y_{ij}}\right\}$

Approaches other than these three basic alternatives obviously exist. For example, the analysis of the number of viewers per viewing household or per TV set switched on has shown this to be very stable during the same time intervals. The detection of variations in this parameter has proven very useful when it comes to analysing the impact of a "perturbing actions".

Extreme consumption of a channel (or of total television)

The most frequently used systems are described below.

- Classical method. The quasi-variance of the sample is calculated: $s^2 = \dfrac{\sum (y_i - \bar{y})^2}{n-1}$, where n is the number of observations and the viewing is considered extreme y_i when $|y_i - \bar{y}| \geq ks$, where k is a parameter to be chosen. It parts from the not-very-realistic hypothesis of distribution normality and does not work very well when there is more than one extreme case.

  Equivalently, the following criterion (number of times the average) is sometimes also used:
  $\dfrac{y_i}{\bar{\bar{y}}} \geq k_1$ or $\dfrac{y_i}{\bar{\bar{y}}} \leq k_2$

- Robust method. The interquartile range r is taken as measure of the dispersion and the median m as measure of the centre value of the distribution. All observations outside the interval $[m - kr, m + kr]$ are classified as extreme. As in the previous case, the following variant can be used:

  $\dfrac{y_i}{m} \geq k_1$ ó $\dfrac{y_i}{m} \geq k_2$

- Percentile method. A given percentage of observations are classified as suspicious (for example, 1% of the highest cases). It does not provide direct information on the distance from the pattern considered standard.

- Fuller's algorithm. Considers the observations sorted by magnitude:

  $y_1 \leq y_2 \leq y_3 \leq .... \leq y_{n-1} \leq y_n$

With $A = \sum_{i=1}^{n-2} y_i$ and $K = \frac{A + 2y_{n-1}}{n-1}$

y_n is considered extreme if

$\frac{y_n - y_{n-1}}{K} \geq F$ where the value of F varies as a function of *n*.

Obviously, this system does not work well either when there is more than one extreme case.

Extreme affinity

The methods mentioned under the heading *Extreme consumption* can also be of application here. Nevertheless, given the special characteristics of the share distribution (values between zero and 100), using the Index of Inequality provided by the Information Theory would seem to be of particular interest and utility in determining extreme values.

Index of inequality

Basically, the idea is to establish the distance or degree of inequality between the affinity shown by an individual towards the channels, affinities quantified by the values of the respective shares, and the set of shares that it is convenient to use as the referent of normal behaviour.

In a first approximation, this referent could be the series of shares that corresponds to the geographical region to which the audited individual belongs, although segments provided by variables other than geographical ones (equipment, age groups, etc.) can also be used.

Mentioned inequality between the two sets of shares is measured using:

$$I = \sum_{i}^{n} p_i \, ln \frac{p_i}{p_i^*}$$

calculated for each individual of the panel and where:

p_i: is the share of channel *"i"* of the television consumption of the panel member.

p_i^*: the average share of channel *"i"* in the geographical region to which the individual belongs.

The function thus established fulfils three properties desired of an index of this kind:

1) It takes the value "zero" if, and only if, the two sets to be compared are exactly equal.

2) If the two sets are not exactly equal, the value of I will always be positive.

3) It has the following additive property:

If the *"n"* elements of the sets of shares are combined to form *"k"* subsets each consisting of "n_j" original elements so that each original element *"i"* belongs to one, and only one, of the subsets $\left(\sum_{j=1}^{k} n_j = n\right)$, the value of I will be equal to the sum of the functions for the *"k"* subsets plus the values of the functions within each subset (expressing the individual values within the subset as shares of the subset) and weighting each subset by the actual share of the subset.

To understand the last condition, let's look at an example. We have two sets of values:

$(p_1, p_2, p_3, ... p_9)$ and
$(p_1^*, p_2^*, p_3^*, ... p_9^*)$

where $\sum_i p_i = \sum_i p_i^* = 1$

We make three groups taking the first three elements, the next four and the last two, and change the notation for greater ease.

$(p_{11}, p_{12}, p_{13}, p_{21}, p_{22,}, p_{23}, p_{24}, p_{31,} p_{32})$ and
$(p_{11}^*, p_{12}^*, p_{13}^*, p_{21}^*, p_{22}^*, p_{23}^*, p_{24}^*, p_{31}^*, p_{32}^*)$

Let's calculate the shares of the grouped data:

$S_1 = p_{11} + p_{12} + p_{13}$ $\quad S_1^* = p_{11}^* + p_{12}^* + p_{13}^*$
$S_2 = p_{21} + p_{22} + p_{23} + p_{24}$ $\quad S_2^* = p_{21}^* + p_{22}^* + p_{23}^* + p_{24}^*$
$S_3 = p_{31} + p_{32}$ $\quad S_3^* = p_{31}^* + p_{32}^*$

Condition 3 establishes that:

$$I(p_i, p_i^*) = \sum_{i=1}^{n} p_i ln \frac{p_i}{p_i^*} = I(S_j, S_j^*) + \sum_{j=1}^{k} S_j I\left(\frac{p_{jh}}{S_j}, \frac{p_{jh}^*}{S_j^*}\right)$$

which in our specific case (with n=9, k=3) we could develop as

$$I(p_i, p_i^*) = \sum_{i=1}^{9} p_i ln \frac{p_i}{p_i^*} = \sum_{j=1}^{3} S_j ln \frac{S_j}{S_j^*} + \sum_{j=1}^{3} S_j \sum_{i=1}^{n_j} \left(\frac{p_{ji}}{S_j} ln \frac{p_{ji}/S_j}{p_{ji}^*/S_j^*} \right) =$$

$$= \sum_{j=1}^{3} S_j ln \frac{S_j}{S_j^*} + S_1 \sum_{i=1}^{3} \left(\frac{p_{1i}}{S_1} ln \frac{p_{1i}/S_1}{p_{1i}^*/S_1^*} \right) + S_2 \sum_{i=1}^{4} \left(\frac{p_{2i}}{S_2} ln \frac{p_{2i}/S_2}{p_{2i}^*/S_2^*} \right) + S_3 \sum_{i=1}^{2} \left(\frac{p_{3i}}{S_3} ln \frac{p_{3i}/S_3}{p_{3i}^*/S_3^*} \right)$$

In the last term of the expression, the first addend would express the inequality “between groups” and the other three addends represent the inequality internal to each one of the groups.

Contribution to the index explained by the individual networks

Making use of property 3 mentioned above, we can consider as measure of the contribution of each network/element to the total inequality, the value of the inequality between groups when the grouping is carried out in two parts: the element or network to be analysed on one hand and everything else on the other. We designate this contribution as Di, and its value would be expressed by:

$$D_i = p_i \ln \frac{p_i}{p_i^*} + (1 - p_i) \ln \frac{(1 - p_i)}{(1 - p_i^*)}$$

Experimentation carried out

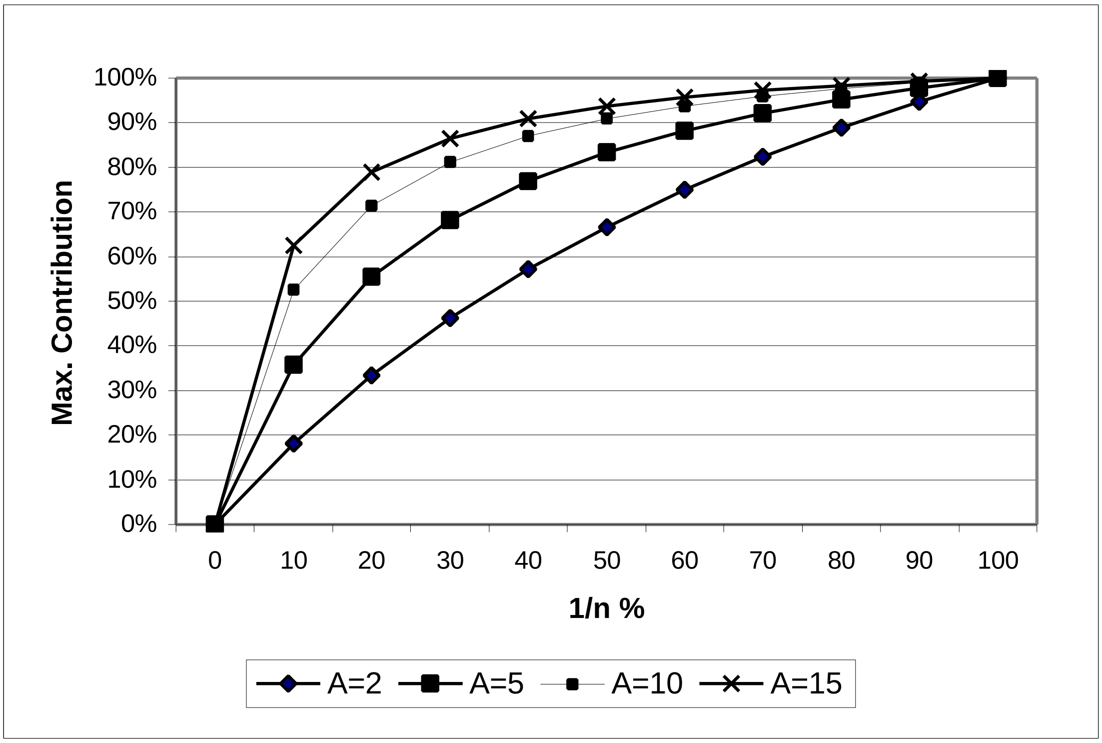
AIMC performs this analysis on a regular monthly basis on the Sofrés AM panel data (22 channels). The average values obtained for I and the Di’s in the last exercise where 0.41 and 0.02. If we choose to consider suspicious 1% of the extreme cases, we can locate them through the conditions I>2.25 and Di>0.31 in accordance with the values for percentile 99% of the respective distributions.

Extreme contribution

It is easily seen that the maximum admissible contribution should vary with the number of panellists consumers of the network during the period studied. If only one panellist has tuned into a given network, obviously said panellist's contribution will be 100% and this value cannot be considered unexpected. On the other hand, if there are 100 viewers of a network, any contribution above 50% would have to be considered highly suspect.

We have decided to consider the following formula $Maximum\_contribution = \frac{A}{A+n-1}$ to determine the maximum admissible values of contribution, where A is a value to be set according to the distribution of observations detected in the panel in such a way that the number of cases superior to the level established is a reasonable number of cases (around 1%).

We have experimented with different values of A



and have found that the optimum for a monthly analysis is between 4 and 6. This optimum value does not vary significantly when the period considered in the study is lengthened.

Coviewing Index

Panel household member self-discipline when it comes to registering his- or herself has traditionally been considered one of the weaker elements of the meter panel operation.

Among the additional analyses performed to complement the classic test of "Internal Coincidental Analysis" and allow determining a panellist's level of self-control is to monitor the degree of coviewing that takes place.

The objectives are as follows:

- To determine for each possible pair of viewers in the panellist households the percentage of coviewing ("watching the same channel at the same time"), measured by the index:

$$Indice_{ij} = \frac{2 * m_{ij}}{m_i + m_j}$$

  m_i Viewing time in minutes of individual

  m_j Viewing time in minutes of individual j

  m_{ij} Shared viewing time of individuals ij in minutes

  This index takes the value "1" when all the viewing minutes of individuals *i,j* are shared, and uses the value "zero" when not a single minute of TV viewing time is shared.

- To indicate the cases of pairs of viewers or households with extreme index values, which could indicate serious breakdowns in registration process discipline. These cases should be subject to investigation and follow-up in order to be able to take the appropriate corrective actions.

Through the empirical analysis of the distribution of the index, we have been able to determine that this behaviour is practically indifferent to variables such as the geographical region which the pair of viewers belongs to. Likewise, no significant differences have been detected in the coviewing indices with respect to the day of the week (workday or weekend).

Differences in the index are found, however, with respect to variables like the number of TV sets in a home; indeed, the coviewing index decreases as the number of TV sets in a home rises.

The sex of the pair of viewers is also significant, since the index is quite similar for viewer pairs in which at least one of the members is female, but falls considerably in pairs in which both components are male.

A high correlation is detected between the coviewing index and the age difference of the members of the pair of viewers: the greater the age difference, the lower the coviewing index value.

High correlations are also found with respect to the average number of hours of TV viewing of a pair of viewers and in relation to the number of individuals in the household to which the pair belongs: in the first case, the more hours of TV watched, the higher the index; in the second, the index values fall as the number of individuals in a household increases.

In order to determine which cases merit more detailed investigation, we usually combine the values of the following four variables:

- High coviewing index.
- High total television viewing time.
- Age differences within the viewing pair.
- Employment situation differences within the pair (employed/not employed).

Static intervals

A static interval refers to the period of time during which a television set is switched on but no movement occurs in relation to:

- Signing on / Signing off of viewing individuals.
- Channel switching.
- Teletext usage.

In other words, that time interval during which the TV is on and the meter does not register any change in status whatsoever.

Here, it is worthwhile to determine extreme cases of static intervals because these may indicate breakdowns in the "button-pressing" self-discipline demanded of households (TV set on but without viewers, the viewer has fallen asleep with the TV on, etc.).

To determine the length of the static intervals, we must take into account the possibility that an interval which ends on the last second of one day may continue on into the next second of the following day. In cases where this is confirmed, a "joint" interval should be created and this interval assigned to the day in which the viewing session began.

Taking the month of April 1999 as an example, AIMC detected 11 cases of static intervals of more than 14 hours in duration, and one of more than 35 hours!

Viewing sessions

A viewing session is the period lasting from the moment an individual logs on as a viewer to that in which he registers himself off.

The study of the duration of these sessions, as with the previous case of static intervals, can detect the existence of households that may not be correctly performing their duties as panellists.

The analysis that AIMC carried out on the Sofres AM panel in April 1999 helps to clarify the above. The basic parameters obtained for the distribution of the lengths of the 568,300 sessions that were produced in the panel during this month were as follows:

	Hours
Average	*1.7*
Median	*1.1*
Standard deviation	*2.0*
Maximum value	*48.5*
Percentile 99.0%	*10.3*
Percentile 99.9%	*14.6*

Here, we found 19 viewing sessions of more than 20 hours, of which six (6) exceeded 24 hours, cases that clearly merit additional investigation.

Another way to approach this question would be to study the average duration of viewing sessions for each household or each individual and try to detect those cases with the highest values, presuming that these represent a potential breakdown of habitual discipline in the use of the meter's identification buttons. In our study, we detected seven (7) homes in which the duration of the average session (taking into account the sessions of all household members throughout the month) was more than eight (8) hours.

The distribution of viewing session durations is shown in the following table:

DURATION	SESSIONS	SESSIONS(%)
<1 HOUR	268406	47.2
1 to 2 HOURS	126709	22.3
2 to 3 HOURS	73223	12.9
3 to 4 HOURS	41582	7.3
4 to 5 HOURS	22639	4.0
5 to 10 HOURS	29448	5.2
10 to 15 HOURS	5963	1.0
15 to 20 HOURS	410	0.1
>20 HOURS	19	0.0

The average duration of sessions is also worth noting when these are classified according to the seniority of the households that make up the panel:

Joined panel	No. of Sessions	Average Duration in Seconds	Maximum Value	Median	Percentile 99.0%
1st semester 94	9511	6222.3	62242	4176	34740
2nd semester 94	19493	6013.0	84551	4030	34098
1st semester 95	46913	6455.4	70128	4035	38629
2nd semester 95	38964	6680.0	70879	4335	38025
1st semester 96	74289	6634.3	83974	4290	38515
2nd semester 96	70662	6323.9	135796	3976	37465
1st semester 97	92659	5888.2	90030	3681	35155
2nd semester 97	66771	6118.7	89039	3905	35210
1st semester 98	56460	7237.7	70676	4635	40459
2nd semester 98	45324	5893.1	174548	3782	35110
1st semester 99	47353	5123.0	77171	3020	32430
TOTAL	568399	6248.62	174548	3950	36916

Here we see that the shortest average viewing sessions are recorded for individuals who have been on the panel for less than six (6) months. This fits in with the findings of specific studies on panel fatigue carried out by AIMC, which have shown that the activity of individuals when it comes to signing on and signing off as viewers is significantly different during their first months as panellists, when their average viewing session durations are found to be shorter. The increase in average duration of sessions after these initial months occurs as the result of the panellist becoming less demanding on himself when it comes to pressing the buttons.

Inspection of individual trends

It would also appear to be a good idea to include an analysis in the statistical package for quality control that would detect conspicuous ruptures in the television viewing behaviour tendencies of panel individuals. A significant change from habitual behaviour may owe to an actual event, but it could also reflect the incorrect assignment of an individual's code, problems with voltage/channel correspondence, interference with the panellist by interested parties, simulated artificial television behaviours, meter failures or problems with the information processing, changes in household television equipment, etc. Extreme changes detected should be investigated to determine the end cause that explains them and be able to take the appropriate measures in each case.

On the other hand, extremely stable television viewing behaviour over time may also lead to suspicions of the existence of "perturbing" actions, automated behaviours that do not necessarily coincide with actual viewing, situations that should not be projected upon the viewer universe as a whole, etc. Therefore, extremely stable television viewing behaviours should also be detected and studied.

For this exercise, changes in behaviour were analysed at AIMC on the basis of 4 (four) indicators:

- Total television viewing. The distribution of time between an individual's status of viewing / not viewing was considered.
- Distribution of viewing time among channels.
- Distribution of viewing time among time interval blocks:

  - Block 1: 02:30 – 14:00
  - Block 2: 14:00 – 17:00
  - Block 3: 17:00 – 20:30
  - Block 4: 20:30 – 24:00
  - Block 5: 24:00 – 02:29

- Distribution of viewing time among weekdays (Mon-Fri) and weekends (Sat/Sun). The following procedure was used:

  a) The average daily viewing times corresponding to both weekdays and weekends were calculated.
  b) Viewing time during a standard week was calculated: five (5) times the average viewing time on weekdays plus twice the average viewing time on weekends.
  c) The distribution of viewing times by type of day in relation to the standard week was calculated.

In addition, periods were compared in three different ways:

1. Current month v. previous month. N v.(N-1)
2. Current month v. average of the previous months. N v.(N-1)+(N-2)
3. Average of last two months vs. average of the same two months of the previous year. N+(N-1) v. (N-12)+(N-13)

The algorithm we use to quantify the significance of the changes is the criterion that proceeds from the Information Theory mentioned previously for the study of extreme affinities.

$$I = \sum p_i \ln \frac{p_i}{q_i}$$

where p_i corresponds to the current month or the average of the period that encompasses it and q_i the previous datum against which it is compared. The subscript "i" reflects the different states (viewing / not viewing), the different networks, hour blocks or type of day, depending on which comparison is being made.

To avoid problems stemming from dividing by zero (q_i could be null in some cases), we will use an approximation to the value of I according to the following algorithm:

$$C = \sum \frac{(p_i - q_i)^2}{p_i + q_i} \cong I$$

Cases of high variation encountered may lead to the detection of errors in registration records, variations in household composition, meter faults, etc.

In cases of extreme stability, our aim is to detect robotic or automatic behaviours that could indicate interference from outside the panel aimed at affecting audience share estimates. The most remarkable case detected during out first analysis of this kind (carried out on data from January 2000) was that of a woman who began viewing TV every day at 10.30 and would switch it off at 21.30. The sign-on and sign-off times varied by just a few minutes each day of the month. This, along with the fact that she only watched the regional channel, raised suspicions. After this peculiar behaviour was detected, contact was made with this household to request an explanation. It turned out that the woman in question was ill and lived alone. Every day someone would come in to look after her and move her from the bed to a chair in front of the TV, where she was fed and spent each day. At the end of the day, her assistant returned her to bed. Day after day.

Some general considerations

There are several important elements to consider when it comes to setting up an inspection system:

- Normally, the population is broken down into reasonably homogeneous blocks and a case is considered atypical only after comparing it with the behaviour of this block of the population, not the sample as a whole. The determination of these strata for inspection is usually done by applying geographical, age or equipment criteria, among others.

- The time units of the control. A compromise is sought between the "solidity" of the behaviours (normally associated with intervals of a sufficient length) and the objective of performing frequent controls that provide the capacity to respond quickly (which favours the choosing of short periods). Personally, I tend to favour schemes that use different periods (day, week, month) with controls of varying exigency, increasing the latter as the length of the period grows.

- ♦ The distributions are bounded on the bottom (all observations are positive) and are asymmetric to a greater or lesser degree. This means that the extreme cases are mainly found on the right side of the distribution curve. In other words, many more extreme cases are detected because they are too large than because they are too low. The distribution is also bounded on the top (there is a limit to the number of hours of television viewing per day, 24), but the effects of this bounding are less obvious for our purposes.

- ♦ An important decision to be taken when analysing distributions (to calculate averages, medians, spreads, etc.) is whether to include observations with the value zero or, on the contrary, only include those that are strictly positive, the option I personally prefer.

Actions stemming from the statistical inspection

From the detection of anomalous cases we move on to a more detailed, in-depth analysis of them and, after contacting the household if the case so requires and permits, to determining the action that should be taken. Basically, there are four alternatives:

- ✓ Taking action is not considered pertinent.

- ✓ Temporary elimination of the individual or household in question.

- ✓ Definition exclusion from the panel.

- ✓ Reducing the expansion factor of the panellist in question to mitigate the effect of his/her extreme behaviour.

Measures of some kind should be taken:

- ♦ When the registered behaviour of the panellist does not correspond with his/her real behaviour or there is grounded suspicion that it does not correspond.

- ♦ When the behaviour recorded by the meter does not correspond to that declared by the panellist (for example, when there is a problem with the meter).

- ♦ When it is presumed that the anomalous behaviour detected, although real and correctly registered and recorded, is of such a nature that it would not appear reasonable to infer that it represents a group of the magnitude reflected by the panellist’s expansion factor. What is colloquially known (although I do not fancy the term) as “non-representative” behaviour.

The *User’s Committee*, the place in Spain where the methodological rules that apply to the TV meter panel are discussed and approved, has always been reluctant to take measures that suppose the temporary or permanent exclusion of a panellist household because of its viewing behaviour, regardless of how strange this might be, as long as there is no real proof that the reported behaviour does not correspond to the actual behaviour. Since such proof is hard or impossible to obtain, the detection of suspect or atypical behaviours does not imply, in many cases, the taking of a corrective action on the part of Sofrés. A few months ago, and upon AIMC initiative, the Comité de Usuarios was presented with the proposal of rules for exclusion attached hereto as an Appendix. This proposal included a series of rules and actions to be taken only in truly extreme cases. Even so, the proposal was only approved in part.

Appendix I
Proposal of rules for exclusion

High total television viewing times *Approved*

- ✓ Exclude a household from the usable sample of the day when a person views more than 20 hours (1200 minutes) of total television.

- ✓ Exclude definitively from the panel those households that, during the month studied, have been eliminated from the daily usable sample at least 5 times based on the above-mentioned rule.

- ✓ Exclude definitively from the panel those households in which, during the month analysed, at least one individual has registered an average daily viewing time of more than 15 hours (900 minutes). To make this average sufficiently solid, only those households that have been included in the usable sample for at least 20 days during the month will be considered for these purposes.

Extreme affinities with networks *Not approved*

- ✓ Exclude definitively from the panel those households in which, during the month analysed, an individual has registered an average daily viewing time of more than 500 minutes of a single network and the share of said network for the individual in question was at least 85%. The rule of at least 20 days in the usable sample will be applied.

- ✓ Exclude definitively from the panel those households in which, during the month analysed, an individual has registered a share above 95% for a given network with an average viewing time of total television of at least 200 minutes. The rule of at least 20 days in the usable sample will be applied.

Static intervals *Approved*

- ✓ Exclude a household from the usable sample of the day when the duration of the maximum viewing interval without changes (of viewers, networks, teletext use, etc.) exceeds 14 hours (840 minutes).

- ✓ Exclude definitively from the panel those households that, during the month analysed, have been subject to 5 or more daily exclusions due to the application of the previous rule.

Coviewing *Approved*

- ✓ Exclude definitively from the panel those households in which, for at least 5 days of the month, a pair of viewers of the household has registered a coviewing index of more than 90%, and total television viewing time of more than 900 minutes (15 hours) for each individual.