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ROAD PREVENTION AND SAFETY: AN INSTRUMENT FOR MEASURING LOCUS OF CONTROL IN THE SOCIAL MARKETING PERSPECTIVE

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We intend to offer a first contribution to the construction of a new instrument for measuring locus of control in driving behavior. The analysis of the metric properties of the obtained scale, called LOC-db,[1] — conducted through a first exploratory phase and a second confirmative one — shows a good fit to the data of the multidimensional model adopted in the construction of the scale itself. The results obtained show a more frequent external rather than internal locus of control in participants examined, and moreover: substantial differences between expectations of control of old participants compared to the other age groups; between those with lower education and the others; between the more- and less- experienced drivers. In a social marketing perspective, this demands the implementation of several targeted action strategies knowing that, locus of control being a substantially stable element of the personality, targeted interventions of remarkable incisiveness and therefore of considerable commitment and breadth are necessary.

Key words: Social marketing; Locus of control; Road prevention and safety; Driving behavior.

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INTRODUCTION

Social marketing objectives and methodology focus, as is well known, on issues of recognized public utility (Grier & Bryant, 2005; Kotler & Roberto, 1991; Kotler, Roberto, & Lee, 2002; Tamborini, 1995; Tones, 2004), among which road safety has a special relevance.

In this sector, particular attention has been paid to analyzing driving behavior and examining factors that may influence it, in order to devise suitable communication/training initiatives apt to foster safe driving behaviors. In this respect, studying contents and dimensions of the "product" variable, namely, behavior on the road, is the basis of strategies for change, to which social marketing aims especially by working on the promotion/communication variables. A general convergence is needed to intervene effectively on them, since effective communication contents, together with suitable methods and instruments, are precisely what can determine a real change in terms of hazard perception, cognition, and evaluation, in a wider diffusion of behavior styles in keeping with prevention and safety needs (De Carlo & Falco, 2003).

Among the most relevant personal variables in terms of safe driving, is locus of control. Such concept was introduced by Rotter (1966) and further developed in the following years. With it, the author indicates the expectations individuals have, or believe they have, on the possibility to control the effects of their behaviors. It is a personality variable, a general condition

related to environment control, relatively independent from the specific situation, and dependent, instead, on their experiences of the relation between behavior and reinforcement. It is a generalized expectation of one's successes and failures, that may depend not only on internal factors, such as commitment, will, determination, ability, but also on external factors, such as other people's behavior, contextual elements, or fate and luck (Galeazzi, 1994).

The tendency to attribute causes of events to internal factors is defined by Rotter *Internal Locus of Control* (Nigro & Galli, 1988). On the contrary, the tendency to attribute causes to external factors is called *External Locus of Control*. The instrument Rotter developed to measure such construct (the I-E scale) — which is also applied to driving behavior — in general, consists of pairs of items, for each of which participants have to indicate the alternative that most applies to them. After subjecting the instrument to several factor analyses, Rotter ascertained the unidimensionality of the I-E scale (Nigro & Galli, 1988).

In driver psychology, external locus of control has been related to lack of caution, inability to take effective preventative measures and carry out effective strategies to elaborate information (Montag, 1992); some studies moreover suggest that externally-oriented people are more often involved in road traffic accidents (Arthur & Graziano, 1996). However, such relationship does not seem to be always present (see, in this respect, Guastello & Guastello, 2001), in particular when the measure of the construct has been obtained through general instruments (Taris, 1997). It must indeed to be pointed out that in most studies conducted to-date in the field of road psychology, Rotter's general locus of control scale has been used.

While the literature presents several scales for measuring locus of control, even within the same area, driving behavior is essentially addressed only by Montag and Comrey (1987; MDIS scales) created for the Israeli context.

The authors hypothesized the existence of two dimensions, and thus developed two separate scales: one for internality (Driving Internality Scale) and another for externality (Driving Externality Scale); the instrument consists of a total of 30 items, 15 of which measuring internal-orientation and 15 external-orientation on a six-point response scale (from 0, *strongly disagree*, to 5, *strongly agree*).

The scale was administered to a sample of 400 male participants divided into two different groups: 200, with an average age of 31.6 years, who had been involved in previous fatal accidents, and 200 who had not been involved in previous accidents, with an average age of 26.5 years. The sample had previously been administered the "lie scale" (Montag L Scale) with the aim of evaluating the effects of social desirability. Factor analysis, conducted with the principal components method, highlighted the existence of two independent factors, internality and externality, characterized by satisfying levels of reliability (Cronbach's α coefficient). As for the validation of the metric properties of the scale, no other statistical data are available. Results have shown statistically significant differences, in the expected direction, between the two groups mean scores: the "accident" participants scored higher on external items and lower on internal items compared to the "non-accident" counterparts.

If on the one hand such results seem to support the hypothesis of a relation between locus of control and involvement in road traffic accidents, on the other the authors themselves address the question of methodology. The scale was administered during a test for the reissue of the driver's license, which is compulsory in Israel when license is withdrawn because of particular health or psychiatric problems, repeated road violations, or involvement in fatal accidents. It

can therefore be hypothesized that the participants may have intentionally increased their externality scores and decreased the internality ones to assume fewer responsibilities.

Again in the perspective of understanding the role played by locus of control, Katwal and Kamalanabhan (2001) compared the driving behavior of 30 bus drivers with a history of frequent road accident involvement, with other 30 drivers with no negative experiences. A questionnaire and specific personality inventories allowed to observe how drivers with a road accident history showed a higher external locus of control compared to the control group.

Taris (1997) analyzed the role of factors such as desirability, behavior controllability, and the possibility of verifying the effects produced on teenagers driving behaviors according to Rotter's locus of control theory (1966). In particular, the study assumes that the socially undesirable behaviors would be more frequent if the behaviors themselves were not knowable by the other participants. The results confirmed that the possibility of one's behavior being known was a factor considered more important by participants with an external attribution style than by those with an internal attribution style, confirming therefore the role of such personality trait.

Miller and Mulligan (2002) estimated the effects of death awareness and locus of control on the risk-taking behaviors of 94 university students. They observed that people with an internal locus, perceiving the discrepancy between the feeling of control over their lives and the awareness of the inevitable uncontrollability of death, tried to have more control avoiding the most risky situations; while those with an external locus considered their actions to be less influential and carried out fewer preventive behaviors.

In a study conducted by Yagil (2001), locus of control and sensation seeking turned out to be important elements, able to influence the will to commit road traffic violations, as argued in Ajzen and Fishbein's Theory of Reasoned Action (1975).

Analysis of the literature has therefore proved how the chance to be involved in road accidents represents, for many participants with a prevalently external locus of control, a greater risk. However, as it has been observed, such relations do not appear to always take place in relation to road behavior when the locus of control is measured through general instruments (Taris, 1997). Unfortunately, in most road psychology studies, Rotter's locus of control general scale is mainly used.

Many research projects have, therefore, been devoted to measuring locus of control, studying issues of dimensionality and specificity-generality of the situations to which control expectancies refer and, as regards the former aspect, many of them have questioned Rotter's I-E scale (1975) unidimensional conceptual structure of control orientation.

The existence of other dimensions had already been hypothesized starting from the middle of the 60s. Several authors identified different dimensions of control; among them, Reid and Ware (1974) highlighted three: "internal space control," "psychological space control," and "person-system transaction control." Bar-Zohar and Nehari (1978) argued that several basic dimensions can be identified within the "locus" construct: "behavioral outcomes," "control ideology," and "situational contents." Lefcourt (1982) as well pointed out the need to identify at least three factors: "goal specificity," "kind of result or experience", and "specific agents able to exercise an influence on individual reinforcement experiences" (Galeazzi & Franceschina, 1994).

An interesting theoretical and methodological reelaboration of LOC in a multidimensional key was formulated by Levenson (1973), who identified three dimensions: the "personal control," the "control exerted by powerful people," and the "control of fate or chance." The "In-

ternal Scale," "Powerful Others Scale," and "Chance Scale" allow to assess the degree of internality-externality on each of the identified dimensions (Nigro & Galli, 1998).

As for the problem of situational specificity, it is noticed that several researchers have often tried to predict specific behaviors using scales designed for general measures. More accurate predictions of actions in specific situations are instead to be obtained by specially-devised instruments. For instance, the definition of locus as expectancy has inclined scholars to consider that such personality trait may change direction or intensity according to the environment in which the individuals interact (Spector, 1988). In such a perspective, instruments were developed to evaluate locus of control aimed at particular contexts among which health, work, economy, affective relations (Galeazzi, 1994).

While several scales for measuring locus of control are present in the literature, even with reference to the same area, only Montag and Comrey's instrument (1987; MDIS scales), developed for the Israeli context, is available for driving behavior (as already stated). Although it includes some items on internal/external control expectancies, its construction was not explicitly based on multidimensional theoretical models. Moreover, the use of such scale, originating in a cultural context different from the Italian, could grant even more partial and limiting information.

Objectives and Methodology of the Research

Probably, what distinguishes the locus of control construct from the many factors influencing driving behavior is its intrinsic feature of being a sort of lens making the "interpretation" of one's own responsibility in relation to the events of life clearer or less defined. The interpretation is, indeed, followed by the choice of carrying out a certain behavior that, in the driving context, may expose to greater or smaller hazards.

It is therefore necessary to investigate the phenomenon using sensitive, valid, and reliable measure instruments, able to detect those diversely relevant elements — depending on the locus of control — on which to implement targeted actions, in the social marketing perspective as well.

The first purpose of the present study lies in such direction. In particular, the aim is to contribute to constructing an instrument for measuring locus of control in the area of driving behavior and to supply the basic elements for a first examination of its characteristics. In order to evaluate the instrument validity, an analysis is performed of the relation of the new specific scale, still susceptible of modifications and adaptations (LOC-db, as will be seen later), with a general measure of the locus of control obtained through Levenson IPC scale (1973) translated and adapted for the Italian context by Nigro and Galli (1988). In particular, the predictive properties of such instruments will be estimated.

The relations between control expectancies and the variability of the participants' responses according to some personal characteristics, among which gender, age, education, experience, involvement in road accidents, and driving behavior, are moreover evaluated.

As is well-known, the measures obtained from the self-report questionnaires can be influenced by the social desirability effect (Boncori, 1993). This is to be studied in the new instrument as well, in relation to the particular behavior that we intend to observe. A further purpose of the present study is therefore that of verifying whether the proposed instrument is sensi-

tive to the effects of social desirability, and to what extent. To this purpose Crowne and Marlowe scale (1960) was used, in the version translated and adapted by Manganelli Rattazzi, Canova, and Marcorin (1998) together with a new specific scale, called L-db, presented here specifically for driving behavior.

THE SAMPLE

The research focused on a sample — identified through a quota non-probabilistic proportional sampling based on gender, age, and education and weighted on the basis of the "accident proness" — of 150 people (holding a driving license), 64 of whom males (42.7%) and 86 females (57.3%), residing in Veneto. As for age, the sample can be divided into three different bands: 78 "young" (ranging in age from 18 and to 34 years), 45 "adults" (aged between 35 and 64), 27 "old" (between 65 and 75). As for driving experience, the sample is composed as follows: 22.7% (n = 35) less than 5 years; 23.3% (n = 35) between six and 10 years; 54% (n = 81) over 10 years. The monthly distance traveled for 44.7% of the sample (n = 67) is below 400 kilometers while for 25.3% (n = 38) it is comprised between 400 and 800, and finally, for the remaining 30% (n = 45) it is over 800 kilometers.

As concerns involvement in "active" (personally-caused) road traffic accidents (quota weighted highlighting the "accident proness" variable) during the past three years, 40.7% (n = 61) of the sample incurred them, while 59.3% did not. Moreover, 37.3% (n = 56) of the sample argued they had incurred penalties during such period.

INSTRUMENTS AND PROCEDURES

The questionnaire submitted to the 150 participants comprises:

1. a first section with some socio-demographic information questions and other questions aimed to assess aspects such as driving experience, involvement in road accidents, penalties incurred (if any), use of seat belt;
2. the LOC-db (Locus of Control — driving behavior) specifically elaborated for road prevention and safety issues, together with L-db (LIE — driving behavior) a new scale for measuring social desirability; both scales were designed, developed, and applied in this research for the first time;
3. the "Internality, Powerful Others, and Chance" (IPC) general scale by Levenson and Miller (1976) translated by Nigro and Galli (1988), together with Crowne and Marlowe's scale of social desirability (1960), translated and adapted to the Italian context by Manganelli Rattazzi, Canova, and Marcorin (1998);
4. the "Driver Behaviour Questionnaire" (DBQ) scale by Parker, Reason, Manstead, and Stradling (1995) for measuring driving behavior.

The LOC-db Scale (First Version)

It consists of 34 items expressing "control expectancies" (namely attributions of internal or external responsibilities) relative to three dimensions: internal control (12 items), external

control by environmental factor (12 items), and external control by chance and luck (10 items). Sentences were worded partly internally-oriented and partly externally-oriented; so that in 22 items, a strong agreement is an index of externality, while in the other 10 agreement indicates an internal locus of control. Items are of new formulation and were developed also referring to scales for measuring locus of control in different areas than driving.

The response options have six points, without neutral point, from 1 (*strongly disagree*) to 6 (*strongly agree*). The Likert-type response format was chosen according to several studies maintaining that such format allows for more reliable measures than those deriving from Rotter's forced choice format; moreover, Likert-type scales are more suitable for multidimensional structures (Marsh & Richards, 1986).

The LOC-db scale follows, with items numbered as in the questionnaire; to make things clearer**,** items marked with (I) belong to the internal locus dimension; those marked with (A) refer to the external locus-environment dimension; those with (C) refer to the external locus-chance or misfortune dimension.

1. When it rains, it is always difficult to drive safely. (A)
2. Not causing road accidents depends on the good or bad luck of each of us. (C)
3. Each person is responsible for what happens to him/her while he/she is driving. (I)
5. Because of children's lack of attention, it is very difficult to avoid road accidents that may involve then. (A)
6. Misfortune causes many road accidents. (C)
7. Most road accidents happen because of errors made by road users. (I)
9. Driving in heavy traffic conditions makes it difficult to avoid accidents. (A)
10. When driving, what is going to happen will happen. (C)
11. The difference between people who have accidents and those who don't rests in the driver's caution. (I)
13. The large number of heavy vehicles on the road makes it difficult to avoid accidents. (A)
14. Driving without getting into accidents is mainly a matter of luck. (C)
15. A very careful driver hardly gets into any accidents. (I)
17. It is very difficult to avoid road accidents involving elderly people because of their limited sight and hearing abilities. (A)
18. Road accidents depend in large measure on accidental events. (C)
19. It is always possible to predict with our choices and behavior what may happen while we are driving. (I)
21. It is very difficult to avoid road accidents that may involve pedestrians. (A)
22. When driving it is difficult to foresee what may happen. (C)
23. Most accidents happen because of the driver's distraction: misfortune has nothing or little to do with them. (I)
25. Road accidents largely depend on the little consideration given to road issues by the authorities in charge of circulation. (A)
26. Fate causes many road accidents. (C)
27. Most road accidents happen because of lack of awareness of one's own responsibility. (I)
29. The state not intervening is among the main causes of road accidents. (A)
30. It is enough to be in the wrong situation and/or at the wrong time to get into a road accident. (C)

31. Preventing accidents depends only on the driver and his behavior rather than on external factors. (I)
33. In case of poor road sign posting it is very difficult to drive safely. (A)
34. Road accidents are governed by chance. (C)
35. Very often one gets into road accidents because one doesn't observe speed limits. (I)
37. Enforcing harsher sanctions allows to reduce the number of road accidents. (A)
38. Most accidents are due to the driver's lack of caution and attention. (I)
39. Getting into few road accidents depends on fate. (C)
40. If the road is damaged it is very difficult to drive safely. (A)
41. Not getting into accidents is a matter of caution. (I)
42. When the weather is bad it is impossible to drive safely. (A)
44. It is always individuals who are responsible for their own accidents. (I)

The L-db Social Desirability Scale

This scale, developed for the present study as well, aims to measure people's tendency to portray themselves according to socially-shared criteria. It consists of nine items selected through several preliminary surveys taking into account the most common infractions. In this case as well the response options are six, as previously described. Items of the L-db scale (that follow) have been randomly inserted in the LOC-db scale.

4. When I'm driving I never use the cell phone without earpiece.
8. When I'm driving I always observe speed limits.
12. Sometimes when I'm driving I don't observe safety distance.
16. I never drink alcohol before driving.
20. I don't always have a positive disposition towards other road users.
24. I never get nervous with other road users when I'm driving.
28. Sometimes when I'm driving I don't observe road rules.
32. When I'm driving I always slow down at pedestrian crossings.
36. When I'm driving I avoid all kind of distractions.
43. When I'm driving I honk only in case of real emergency.

The IPC Scale[2]

The IPC version that was used in the present study is the one translated and adapted to the Italian context by Nigro and Galli (1988); compared to Levenson original scale (1973), three items were eliminated since in previous applications they turned out to be not perfectly homogeneous with the respective subscales. The IPC scale consists of 21 items expressing expectancies with respect to three dimensions defined by Levenson: "internal control" (seven items), "external control-powerful others" (seven items), and "external control-luck" (seven items). Respondents were invited to express their degree of agreement with each of the sentences, using in this case as well six alternatives without neutral point, from 1 (*strongly disagree*) to 6 (*strongly agree*).

The IPC scale follows. Items marked with (P) belong to the external locus-powerful others dimension; those with (C) belong to the external locus-chance or misfortune; and those with (I) relate to the internal locus.

1. When I make plans, I am almost certain to make them work. (I)
2. To a great extent my life is controlled by accidental happenings. (C)
3. I feel like what happens in my life is mostly determined by powerful people. (P)
4. Whether or not I get to be a leader depends mostly by my ability. (I)
5. Often there is a chance of protecting my personal interests from bad luck happenings. (C)
6. When I get what I want, it's usually because I'm lucky. (C)
7. Although I might have good ability, I do not want to assume leadership responsibility without appealing to those in positions of power. (P)
8. I have often found that what is going to happen will happen. (C)
9. My life is chiefly controlled by powerful others. (P)
10. People like myself have very little chance of protecting our personal interests when they conflict with those of strong pressure groups and people. (P)
11. It's not wise for me to plan too far ahead because many things turn out to be a matter of good or bad fortune. (C)
12. Getting what I want requires pleasing those people above me. (P)
13. Whether or not I get to be a leader depends on my having good or bad luck. (C)
14. If important people were to decide they didn't like me, I probably wouldn't make many friends. (P)
15. I am usually able to protect my personal interests. (I)
16. When I get what I want, it's usually because I worked hard for it. (I)
17. In order to have my plans work, I make sure that they fit in with the desires of people who have power over me. (P)
18. My life is determined by my own intentions. (I)
19. It's chiefly a matter of fate whether or not I have a few friends or many friends. (C)
20. How many friends I have depends on how nice a person I am. (I)
21. I can pretty much determine what will happen in my life. (I)

The General Social Desirability Scale

The original scale (Crowne & Marlowe, 1960) consists of 33 items and has dichotomic response options (true or false); in this study a short form translated by Manganelli Rattazzi, Canova, and Marcorin (1998) was used, with six points of choice without neutral point: from 1 (*strongly disagree*) to 6 (*strongly agree*), just as in the previous cases. The items from the general social desirability scale, that follow, were inserted randomly in the IPC scale.

1. No matter who I'm talking to, I'm always a good listener.
2. There have been a few occasions when I took advantage of someone.
3. I'm always willing to admit when I make a mistake.
4. I sometimes try to get even, rather than forgive and forget.
5. I am always courteous, even to people who are difficult.

6. I have never been irked when people expressed ideas very different from my own.
7. There have been times when I was quite envious of the good fortune of others.
8. I am sometimes irritated by people who ask favours of me.
9. I have never deliberately said something that hurt someone's feelings.

The Driver Behaviour Questionnaire Scale

This scale, developed by Parker *et al.* (1995), was translated and adapted to the Italian context for this study, also taking into account later integrations made by the same authors (Parker, Lajunen, & Stradling, 1998). It is an instrument that allows to identify four different classes of risk-taking behaviors: lapses (Stradling-Manchester study), errors, violations, and aggressive violations (originally the scale comprised violations grouped in only one category). Respondents were asked to indicate how frequent a certain behavior was for them, and invited to answer by means of a six-point Likert-type scale, without neutral point, from 1 (*Never*) to 6 (*Nearly all the time*).

Lapses:

1. Hit something when reversing that you had not previously seen?
2. Try to pull away from the traffic lights in the wrong gear?
3. Forget where you left your car in the car park?
4. Switch on one thing when you meant to switch on another?
5. Take the wrong lane approaching a roundabout or junction?
6. Realise you have no clear recollection of the road along which you have just been travelling?
7. Misread the signs and exit from a roundabout on the wrong road?
8. Intending to drive to destination A, you "wake up" to find yourself on the road to destination B, perhaps because the latter is your more usual destination?

Errors:

9. Fail to check your rear-view mirror before changing lanes?
10. Underestimate the speed of an oncoming vehicle when overtaking?
11. Brake too quickly on a slippery road, or steer the wrong way in a skid?
12. On turning nearside, fail to see a cyclist who has come up on your inside?
13. Fail to see a 'Stop' or "Give Way" sign and narrowly avoid colliding with traffic having right of way?
14. Fail to notice that pedestrians are crossing when turning into a side street from a main road?
15. Queuing to turn onto a main road, you pay such close attention to the mainstream of traffic that you nearly hit the vehicle in front?
16. Attempt to overtake someone you hadn't noticed to be signalling an offside turn?

Violations:

17. Disregard the speed limits late at night or very early in the morning?
18. Cross a junction knowing that the traffic lights have already turned against you?
19. Drive especially close to the car in front as a signal to its driver to go faster or get out of the way?
20. Drive even though you realise you are over the legal blood-alcohol limit?

21. Get involved in "races" with other drivers?

Aggressive violations:

22. Have an aversion to a particular class of road user, and indicate your hostility by whatever means you can?
23. Angered by another driver's behaviour, you give chase with the intention of giving them "a piece of your mind?"
24. Get impatient with a slow driver and overtake on the inside?
25. Sound your horn to indicate your annoyance to another driver?
26. Pull out of a junction so far that the driver with right of way has to stop and let you out?

ANALYSES OF THE DATA

The LOC-db Scale (Second Version)

The evaluation of the metric properties of such scale was carried out through a first exploratory phase and a second confirmatory one, devoted to the analysis of the fit to data of the multidimensional model adopted in the construction of the scale.

Initially, the distribution indices (mean, median, minimum-maximum values) were analyzed, as well as normality (kurtosis and skewness), internal consistency (Cronbach's α coefficient), and scale homogeneity (interitem correlations). A first test of the scale multidimensionality was conducted by means of factor analysis.

In the second phase, a model of confirmatory factor analysis was tested. This analysis was conducted by using LISREL 8 (Joreskög & Sörbom, 1993).

The examination of the responses distribution to the individual items suggested the elimination of item 18, because of its low discriminative power. It had a mean of 2.58 with a standard deviation of 1.16, and a high concentration of responses mainly in the three levels of disagreement; kurtosis, equal to 2.14, was also high.

The correlation matrix was analyzed according to principal components. Results of this analysis suggested the elimination of items 37 and 38 as they were bifactorial.

The exploratory factor analysis was repeated on the 31 items obtained. In order to define the number of components — then fixed at three — scree-test was used (Cattell & Vogelman, 1977), together with the theoretical model adopted for the construction of the scale. Oblimin rotation was used, since a positive correlation was assumed between the two dimensions of external control.

The three factors altogether explained 42.84% of the total variance. However, in the first factor (external locus-chance) three items were present (21, 23, 5) that did not belong to the theoretical dimension corresponding to such factor; and the same applied to items 38 and 30 for the second factor (external locus-environment); therefore these five items were eliminated. Moreover, items 1, 3, 9, 18, 22, and 37 were excluded as well since they were lowly loaded on the respective factor.

The analysis was then repeated on the 22 resulting items. The three factors altogether explained 52.67% of the total variance. Items 34, 26, 39, 10, 14, 2, 6 were highly loaded on the

first factor (loadings ranged from .74 to .84); as regards the second factor, external locus-environment, the seven items pertinent to such dimension: 33, 40, 25, 29, 42, 17, 13 presented high loadings ranging between .51 and .75; finally, the third factor was expressed by eight of the 12 items designed to measure the internal locus dimension (items 15, 7, 11, 44, 31, 41, 19, 27), with loadings ranging between .41 and .81. The first and the second factors were correlated (r = .49, $p < .001$), the second was independent from the third, whilst a lower correlation between the external locus-environment and the internal locus was present.

The scale, in its final version, therefore, consists of 22 items: eight in the external locus-chance subscale with a reliability of .92; seven in the external locus-environment subscale with a reliability .81; seven, finally, in the internal locus subscale with a reliability of .75. The internal consistency and reliability of the scale, estimated by means of item-total correlation and α coefficient, were, therefore, satisfactory (Tables 1, 2, 3).

In the second phase of testing the metric properties, a model of confirmatory factor analysis was evaluated with 22 observed variables and correlated factors. In order to check the goodness of fit to data of the hypothesized model, the following indices were applied:

– χ^2;
– RMSEA (Root Mean Square Error of Approximation); the solution is acceptable when it is equal or lower than .08 (Bollen & Long, 1993);

TABLE 1
Analysis of the internal consistency for the external locus-environment scale[3]

	Item	*M*	*SD*	Item-total correlation	α in absence of the item
33	In case of poor road sign posting it is very difficult to drive safely.	4.13	1.39	.61	.77
40	If the road is damaged it is very difficult to drive safely.	4.28	1.23	.63	.77
25	Road accidents largely depend on the little consideration given to road issues by the authorities in charge of circulation.	2.99	1.44	.62	.77
29	The state not intervening is among the main causes of road accidents.	3.07	1.40	.59	.78
42	When the weather is bad it is impossible to drive safely.	3.80	1.46	.53	.79
17	It is very difficult to avoid road accidents involving elderly people because of their limited sight and hearing abilities.	3.27	1.37	.50	.79
13	The large number of heavy vehicles on the road makes it difficult to avoid accidents.	3.70	1.35	.35	.82
	α = .81				

TABLE 2
Analysis of the internal consistency for the external locus-chance or misfortune scale

	Item	*M*	*SD*	Item-total correlation	α in absence of the item
34	Road accidents are governed by chance.	2.21	1.31	.74	.91
26	Fate causes many road accidents.	2.33	1.32	.81	.90
39	Getting into few road accidents depends on fate.	2.35	1.38	.77	.91
10	When driving, what is going to happen will happen.	2.49	1.54	.70	.92
14	Driving without getting into accidents is mainly a matter of luck.	2.34	1.24	.78	.91
2	Not causing road accidents depends on the good or bad luck of each of us.	2.52	1.53	.74	.91
6	Misfortune causes many road accidents.	2.45	1.34	.75	.91
	α = .92				

TABLE 3
Analysis of the internal consistency for the internal locus scale

	Item	*M*	*SD*	Item-total correlation	α in absence of the item
15	A very careful driver hardly gets into any accidents.	2.85	1.22	.63	.69
7	Most road accidents happen because of errors made by road users.	2.73	1.21	.59	.70
11	The difference between people who have accidents and those who don't depends on the driver's caution.	2.59	1.13	.51	.72
31	Preventing accidents depends only on the driver and his behavior rather than on external factors.	2.91	1.10	.41	.73
44	It is always individuals who are responsible for their own accidents.	2.79	1.09	.49	.72
41	Not getting into accidents is a matter of caution.	2.45	1.00	.37	.74
19	It is always possible to predict with our choices and behavior what may happen while we are driving.	3.55	1.35	.31	.76
27	Most road accidents happen because of lack of awareness of one's own responsibility.	2.66	1.24	.30	.75
	α = .75				

– CFI (Comparative Fit Index); values above .90 are usually considered satisfactory (Bentler, 1990);
– RMRS (Root Mean Square Residual Standardized); values equal or below .08 are considered as acceptable (Bollen & Long, 1993).

Results relative to the goodness-of-fit indices, together with factor loadings, are shown in Tables 4, 5, and 6. Indices prove that the model gives a good explanation of the data: the three-factor solution can therefore be accepted. Moreover, factor loadings confirmed the relation between the single item and the hypothesized latent variable. The only exception was χ^2 which was, anyway, lower than double the degrees of freedom.

The first two latent variables, external locus-chance and external locus-environment, were correlated $\Phi = .56$ ($t = 8.01$, $p < .001$), while the third, internal locus, was independent from external locus-environment $\Phi = .11$ ($t = 1.02$, *n.s.*), and at the same time not highly correlated with external locus-chance or misfortune $\Phi_{13} = .38$ ($t = 4.26$, $p < .001$).

Thus, as far as driving behavior is concerned, *control expectancies are multidimensional*. The latter are better evaluated by scores measuring participants' position with respect to the three control sources (internal, external-chance or misfortune, external-environment), rather than by only one score placing each participant between the internal-external polarities.

The Relation Between LOC-db and IPC Scales

The relationship between the LOC-db scale and Nigro and Galli IPC scale (1988) was analyzed after checking the reliability of IPC. The three sub-scales "external locus-powerful others," "external locus-chance," and "internal locus" had the following coefficients: .81, .82, .71, in our sample.

TABLE 4
Confirmatory analysis — internal locus scale

	Item	λ
15	A very careful driver hardly gets into any accidents.	.54
7	Most road accidents happen because of errors made by road users.	.49
11	The difference between people who have accidents and those who don't depends on the driver's caution.	.60
31	Preventing accidents depends only on the driver and his behavior rather than on external factors.	.57
44	It is always individuals who are responsible for their own accidents.	.69
41	Not getting into accidents is a matter of caution.	.47
19	It is always possible to predict with our choices and behavior what may happen while we are driving.	.35
27	Most road accidents happen because of lack of awareness of one's own responsibility.	.31

$\chi^2 = 422{,}05$; $df = 203$; $\chi^2/df = 2{,}08$; RMSEA = .080; CFI = .92; RMRS = .078.

TABLE 5
Confirmatory analysis — external locus chance or misfortune

	Item	λ
34	Road accidents are governed by chance.	.76
26	Fate causes many road accidents.	.87
39	Getting into few road accidents depends on fate.	.81
10	When driving, what is going to happen will happen.	.72
14	Driving without getting into accidents is mainly a matter of luck.	.83
2	Not causing road accidents depends on the good or bad luck of each of us.	.74
6	Misfortune causes many road accidents.	.74
$\chi^2 = 422{,}05$; $df = 203$; $\chi^2/df = 2{,}08$; RMSEA = .080; CFI = .92; RMRS = .078.		

TABLE 6
Confirmatory analysis — external locus environment

	Item	λ
33	In case of poor road sign posting it is very difficult to drive safely.	.66
40	If the road is damaged it is very difficult to drive safely.	.71
25	Road accidents largely depend on the little consideration given to road issues by the authorities in charge of circulation.	.70
29	The state not intervening is among the main causes of road accidents.	.69
42	When the weather is bad it is impossible to drive safely.	.64
17	It is very difficult to avoid road accidents involving elderly people because of their limited sight and hearing abilities.	.56
13	The large number of heavy vehicles on the road makes it difficult to avoid accidents.	.38
$\chi^2 = 422{,}05$; $df = 203$; $\chi^2/df = 2{,}08$; RMSEA = .080; CFI = .92; RMRS = .078.		

The correlations between the two scales are the following: external locus-chance dimensions, present in both scales, .66 ($p < .001$); internal locus, present in both scales as well, .35 ($p < .01$); external locus-environment (present in the LOC-db) and external-locus powerful others (in the IPC), .40 ($p < .001$). The relation was satisfying for the last dimensions as well, even though the specific locus of control scale (LOC-db) contained some items more precisely determined than those of the general locus scale (IPC), and yet still amenable to external factors not depend-

ent on the individual's controllability. Results, therefore, highlighted a substantial relation between the subscales of the two instruments.

The Relation Between LOC-db and the Social Desirability Scales

A further aim of the study was to test how sensitive the LOC-db scale was to the effects of social desirability by means of the analysis of correlations between the scale L-db (LIE-driving behavior) and Crowne and Marlowe general social desirability scale.

First of all, the properties of L-dg were evaluated: an exploratory factor analysis was carried out using principal components, which revealed a monodimensional structure explaining 42.26% of variance. Items 8, 28, 16, 32, 4, 36, 12, and 24 were highly loaded on this factor with values ranging between .54 and .80; items 43 and 20 had instead low loadings, and were therefore eliminated. The scale internal consistency and reliability estimated through item-total correlations and Cronbach α (α = .80), were good (Table 7).

TABLE 7
Analysis of the internal consistency of the L-db scale

	Item	*M*	*SD*	Item-total correlation	α in absence of the item
4	When I'm driving I never use the cell phone without earpiece.	3.89	1.88	.49	.78
8	When I'm driving I always observe speed limits.	3.79	1.54	.69	.75
12	Sometimes when I'm driving I don't observe safety distance.	3.51	1.48	.43	.79
16	I never drink alcohol before driving.	4.31	1.73	.56	.77
24	I never get nervous with other road users when I'm driving.	2.79	1.44	.41	.79
28	Sometimes when I'm driving I don't observe road rules.	3.57	1.37	.55	.77
32	When I'm driving I always slow down at pedestrian crossings.	4.05	1.43	.49	.78
36	When I'm driving I avoid all kind of distractions.	3.92	1.33	.48	.78
	α = .80				

In order to determine the validity of the L-db scale, it was correlated with Crowne and Marlowe general social desirability scale (α = .72). The correlation between the two scales was .53 ($p < .001$).

Finally, the relation between LOC-db and each of the two social desirability scales was analyzed. Correlations were not significant, $p > .49$. Thus, social desirability did not influence our scale of locus of control.

Locus of Control and Driving Behavior

A further aim of the present study was to verify whether there were any relations between control expectancies and the variability of the participants' responses according to some personal characteristics. To such aim, a distinction was made on the basis of personal variables such as gender, age, driving habits/history, among which experience, mileage, penalties received, involvement in personally-caused traffic accidents, driving behaviors actually engaged in and identified through the administration of DBQ (Driver Behaviour Questionnaire; Parker *et al.*, 1995).

First, composite scores were calculated for the 3 LOC-db subscales, obtaining the following results:

1. in relation to the possibility of personal control on the events causing road accidents (internal locus) the sample had scores of moderate disagreement ($M = 2.82$, $SD = 0.71$);
2. as for the influence of the external environment on events (external locus-environment), respondents gave overall scores of some agreement ($M = 3.61$, $SD = 0.94$);
3. as regards the role played by chance or fate (external locus-chance or fate), the sample had scores of some disagreement ($M = 2.40$, $SD = 1.14$).

Responses were analyzed, using ANOVA or *t*-test. The independent variables were: G*ender* (male and female). *Age* ("young," from 18 to 34 year-olds; "adult," from 35 to 64; "old," from 65 up). *Education* (elementary/junior high school degree; high school diploma; University degree). *Driving experience* (less than five years, "little driving experience"; from five to 10, "average experience"; more than 10 years, "much experience"). *Kilometers covered monthly* (up to 400, "low mileage"; from 400 to 800, "medium mileage"; more than 800, "high mileage"). *Involvement in accidents* (two categories of people: those who "have caused some road traffic accidents" during the last three years, and those who "have not caused any"). *Seat belt* (use or non-use).

As for the independent variables, only significant data are reported.

With respect to the participants' *age*, one significant effect was observed ($F(2, 139) = 3.506$, $p < .05$), resulting from the differences in scores of the three groups for the eternal locus-chance or fate subscale; although the overall sample tended to deny expectancies of external control by chance and misfortune, such negation was less marked in the elderly ($M = 2.87$ *vs* 2.51 and 2.19).

Regarding *education*, two significant effects emerged: $F(2, 139) = 12.870$, $p < .001$; $F(2, 139) = 2.995$, $p < .05$, since participants with a lower educational level (elementary/junior high school degree) tended to deny expectancies of external control by chance less than people with a high school diploma or graduates ($M = 3.22$ *vs* 2.48 and 2.05); with reference to the expectancies of external control by environmental factors, a similar effect was observed only in graduates ($M = 3.99$ *vs* 3.46).

As regards *driving experience*, the following significant effects emerged ($F(2, 139) = 4.178$, $p < .01$) and ($F(2, 139) = 3.090$, $p < .05$), deriving from differences in scores of the three

groups in the external control-chance or fate and external locus-environment subscales. Overall, participants tended to deny expectancies of external control by "chance or fate" and, even if to a minor extent, by environment; as for "chance or fate" such negation was indeed less strong in participants with "much driving experience" than in those who had "little driving experience" (M = 2.64 *vs* 1.99); with reference to the expectancies of external control by environmental factors a similar effect emerged (M = 3.77 *vs* 3.27).

With respect to *kilometers covered*, a marginal effect emerged ($F(2, 139) = 2.739$, $p < .10$) in the external locus-environment subscale; overall, participants tended to acknowledge control by environmental factors, and in particular "low mileage" people differed from "medium mileage" participants (M = 3.80 *vs* 3.34).

As for *seat belt*, it appears that people, who tend not to use it or use it rarely when driving score significantly higher on the external locus-chance or fate subscale (M = 1.16 *vs* 1.65).

As regards the possible significant differences between control expectancies and *driving behavior*, first, the total mean score of the LOC-db[4] scale (M = 3.00) was estimated, with standard deviation (SD = 0.65), and median (Mdn = 2.95). The latter measure was used to divide the sample into two subgroups: those who are more externally-oriented (scores above the median) and those who are less externally-oriented (scores below the median). After considering the total mean of the composite scores for each of the DBQ scale four dimensions ("violations" M = 1.83; "aggressive violations" M = 1.68; "lapses" M = 2.23; "errors" M = 1.90), Student's t was used to assess the significance of the difference between the means of the two subgroups.

Results are interesting (Figure 1). In all dimensions, with the exception of violations, a significant difference exists between responses given by the two subgroups. In particular, the more externally-oriented participants stated that they committed more "aggressive violations," "errors," and "lapses" ($p < .001$) than the others. The missing relation between external control and "violations" may be surprising also in the light of the positive correlation that emerged between "aggressive violations" and "violations" (r = 42, $p < .001$). When observing the composite mean score associated to the latter it is moreover possible to notice that it is relatively low. That could indicate a certain reluctance of the sample to declare the actual modalities of behaviors in terms of the "violations" variable. Such underestimation is indeed not confirmed if compared with the data collected yearly by the police that, on the contrary, register many infractions of the "violations" category on the drivers' part. That gives rise to the hypothesis of a distortion in the responses due to a kind of social desirability that induced participants to "filter" the responses given to the items. Such hypothesis was tested by calculating the correlation between the score of the "violations" scale and the L-db social desirability scale; since the latter was equal to –.62 the sensitivity of such questions to social desirability bias appears confirmed, in line with what the literature suggests (Montag, 1992).

The Two LOC-db and IPC Scales Compared

We moreover wondered whether, and in which measure, there may be differences between the results obtained with the new LOC-db scale and those derivable from the general indices obtained through the IPC scale. We then compared the composite factor scores of the total LOC-db scale (respectively; internal locus, M = 2.82; external locus-environment, M = 3.61; ex-

ternal locus-chance or fate, $M = 2.40$; total locus, $M = 3.00$) with the relative composite factor scores of the IPC scales (respectively: internal locus, $M = 2.98$; external locus-powerful others, $M = 2.66$; external locus-chance or fate, $M = 2.65$; total locus, $M = 2.66$). Results (Figure 2) showed significant differences among the four scores ($p < .05$).

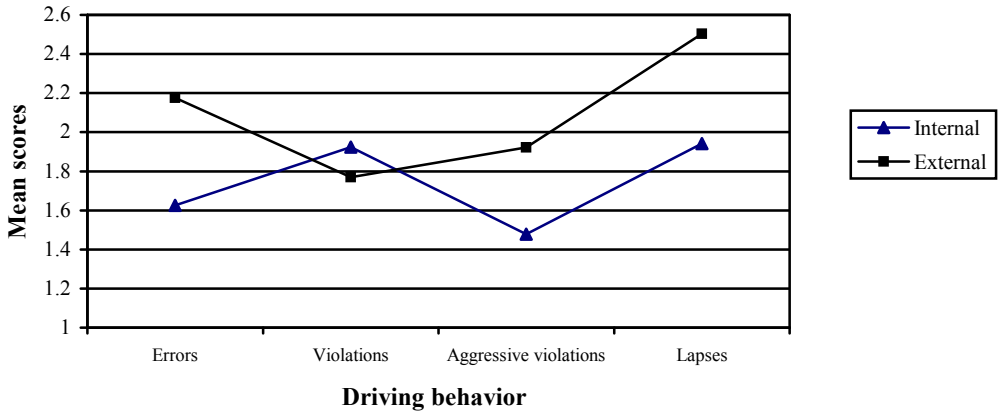

FIGURE 1
Comparison between participants with an "internal" and an "external" locus of control: driving behavior.

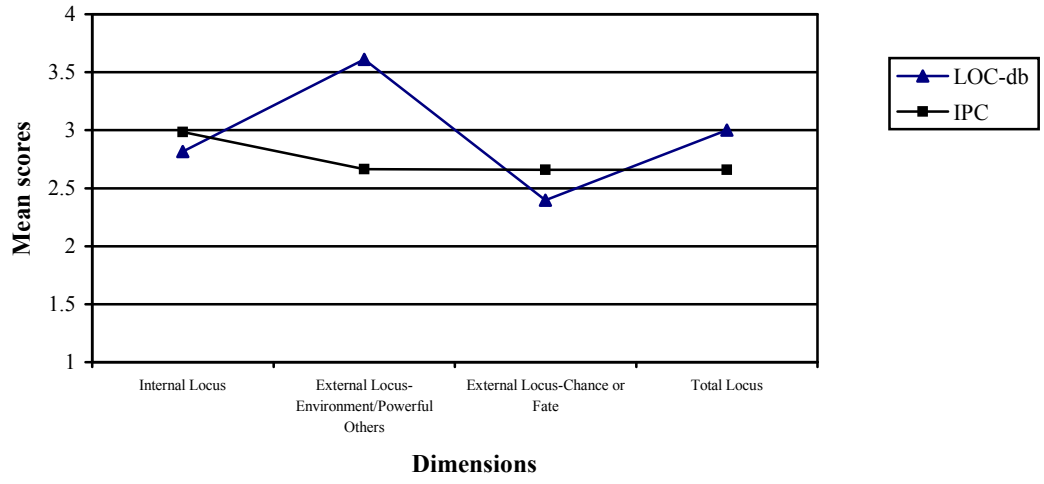

FIGURE 2
Comparisons of the scores obtained with LOC-db and IPC scales.

The results obtained seem to indicate a greater functionality of the specific, rather than general, locus of control scale, in terms of the driving context. Even if generalized expectations,

in the broadest meaning of the term, have a central role in people's behavior, specific experiences can create expectations that are more in keeping with the context.

CONCLUSIONS

In order to work effectively with social marketing issues it is necessary to carefully evaluate the factors that may determine safe or unsafe driving behaviors, also to implement appropriate information/communication activities aimed to improve these behaviors. Among several factors, the locus of control plays an important role, namely the tendency to perceive as determining one's own driving behavior internal conditions or external conditions such as road characteristics, other users' driving style, or chance and misfortune.

Since people at risk belong to different age, education, profession, and social status groups (as the previously cited studies show, providing examples based on extremely diversified samples, such as people who had serious accidents, drivers, taxi drivers, or students of different levels), valid and reliable survey instruments are necessary. They should be sufficiently articulated to assess the specificities of accident-related issues, with reference to different kinds of road users and to their locus of control. The methodological reflection used as premise of this study is therefore essential and, together with studies carried out, has led to a first evaluation of the properties of LOC-db, a new — specific — locus of control scale (also making use of L-db, a new social desirability scale). The LOC-db (just like the L-db) requires further study for diversifying and enlarging the reference samples, and employing other validation strategies; it is also useful to reduce the number of items. It is characterized by some important elements, among which multidimensionality, namely the ability to highlight several essential dimensions of locus of control which allow for a better understanding of driving risk factors, in a social marketing perspective. To this aim, the results obtained have shown a more frequent external, rather than internal, locus of control in the participants examined, and, moreover, substantial differences between expectations of control of old participants compared to other age groups, between those with lower education and the others, between the more- and less-experienced drivers. In a social marketing perspective, this demands the implementation of several targeted intervention strategies of remarkable incisiveness and, therefore, of considerable commitment and breadth also to favor more internally-oriented control expectancies, as in other application fields (see Sharp, Hurford, Allison, Sparks, & Cameron, 1997; Smith-Sebasto, 1995).

The specificity of the LOG-cg compared to general scales should be emphasized, just like the greater predictivity of its constructs in relation to variables such as "errors," "lapses," and "aggressive violations" in driving. This study, moreover, by adding the empirical data relative to the sample considered to those available in the literature, lends further support to the relation existing between locus of control and risk-taking driving behavior.

NOTES

1. The LOC-db scale is available in Italian as well.
2. The text of the IPC scale, the general social desirability scale, and the Driver Behaviour Questionnaire scale is re-translated into English from the slightly adapted Italian form.

3. Numbers on the left are those of the items in LOC-db first version; in the second version, items were randomized.
4. The scale total score was calculated after having inverted the score for the items relative to internal locus of control, so that the higher the score, the higher the level of external control.

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