

## MOTIVATION AND ORGANIZATION. MOTOR: A NOVEL STRATEGIC DEVICE FOR THE MANAGEMENT OF MOTIVATIONS IN ORGANIZATIONS

GIORGIO OSTINELLI

CATHOLIC UNIVERSITY OF MILANO AND BRESCIA

DEPARTMENT OF EDUCATION, CULTURE, AND SPORT (DECS) AT BREGANZONA

ERMANNIO OBERRAUCH

LUCA DIVIANI

UNIVERSITY OF APPLIED SCIENCES AND ARTS OF SOUTHERN SWITZERLAND (SUPSI)

MASSIMILIANO LUNELLI

UNIVERSITY OF MILANO-BICOCCA

ALBERTO MUNARI

UNIVERSITY OF PADOVA

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MotOr (Motivation in Organizations) is a psychological test aimed at measuring the consistency between employees' motivation in organizations and their managers' stated expectations. It consists of two parts: a workshop for the managers and a questionnaire for the employees. Based on the outcomes of the former, a set of desirability functions is calculated, onto which the results provided by the employees are finally projected. A case study is presented and discussed.

Key words: Motivation; Motivation test; Organizations; Power mean; Desirability function.

*Correspondence concerning this article should be addressed to Giorgio Ostinelli, Department of Education, Culture, and Sport – Section of Professional Formation, Via Vergiò 18, 6932 Breganzona, Switzerland. Email: [giorgio.ostinelli@edu.ti.ch](mailto:giorgio.ostinelli@edu.ti.ch)*

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Even if the study of the theoretical foundations of motivation reached its peak during the twentieth century (Ostinelli, 2005; Weiner, 1990), there is still ample room in this field today for the development of applied methodologies. This is indeed the case for the MotOr test (Motivation in Organizations), described in the following pages. Its presentation is divided into three parts: a first, mainly descriptive one, followed by a case study, and by the conclusions.

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## TEST DESCRIPTION

### Employees' Motivation and Behavior in the Workplace

It is widely known that individual motivation manifests itself both in rational and emotional (or nonrational) terms (Atkinson, 1964; Epstein, 1994; McClelland, Koestner, & Weinberger, 1989; Roeser, 2004). Our view is that a form of motivation, the Primary Motivation (PM) — most intrinsic in its character — is developed during the first years of life, mainly throughout the preverbal stage; following this first stage, while increasingly submitted to education, the subject gradually assimilates elements of the Rational Motivation (RM), more extrinsic in their nature. Both forms of motivation can be reciprocally similar or different in their orientation: after all, the presence of contradictory tendencies in humans is a well-known phenomenon (Freud & Einstein, 2010). Our model is mostly inspired by Deci and Ryan's (1985) Organismic Integration Theory. Of great importance is also the conduct of individuals, because it concretely conveys motivation into real behaviors in the workplace: in this work it will be analyzed under the form of employees' Stated Behavior (SB).

### The Five Dimensions of Motivation

MotOr test is based on the concept of need and is deeply rooted in the original ideas expressed by Lewin (1935, 1936). According to Lewin, the individual possesses a range of psychological needs (internal motives) and some goal-objects (in other words, situations) found in the environment possess a number of features able to meet them: for instance, a subject with a strong need for socialization can satisfy his need by becoming a professional vendor. Actually, among all the needs present in a subject, only the stronger — be it rational or irrational — will manifest itself in behavior (Atkinson, 1982).

MotOr is based on a five-dimension model of motivation. The first dimension, Self, is related to the needs for more individualistic versus socializing situations (Allport, 1955; Murray, 1938; Stewart, 1992); the second, Influence, expresses the tendency in people to assume dominant or subordinate positions (Murray, 1938) and is related to the idea of locus of causality (Ryan & Connell, 1989; Weiner, 1992); the third, Variation, measures the propensity toward more innovative or conservative situations (Murray, 1938; Oreg, 2003); the fourth, that of Effectiveness, detects the preference for material versus ideal situations (Jung, 1976); finally, the fifth, Polarity, expresses the subject's inclination toward situations of constructive versus eliminative type (Allen & Greenberger, 1980; Sueki & Eichenberg, 2012). All dimensions are bipolar and describe the universe of possible grades of characters between the two dimensions' extremes (poles): the scale used in MotOr, referred to the case of the Self (Table 1), is shown here.

Column 2 indicates the range of scores (1-8) corresponding to each individual character expressed verbally by the subjects; the scales for the remaining four dimensions are analogous. Score 1 was arbitrarily assigned to the following poles: socializing, dominant, innovative, materialistic, and constructive.

MotOr is part of a wide current of psychological tests which try to analyze employees' motivation through the use of multidimensional models (Hough & Oswald, 2008), like for instance the Big Five factors (Digman, 1990; John & Srivastava, 1999). However, MotOr differen-

tiates itself from the various studies pertaining to the “family” of Big Five factors in particular for the content attributed to the various dimensions, showing only some points in common with the Lorr and Knight (1987) model.

TABLE 1  
 Correspondence between scores and characters for the motivation dimension of Self

Score		Character
Value	Interval	
1	1.0 – 1.5	Extremely socializing
2	1.5 – 2.5	Highly socializing
3	2.5 – 3.5	Moderately socializing
4	3.5 – 4.5	Slightly socializing
5	4.5 – 5.5	Slightly individualistic
6	5.5 – 6.5	Moderately individualistic
7	6.5 – 7.5	Highly individualistic
8	7.5 – 8.0	Extremely individualistic

### A Model Based on Organization’s Expectations

MotOr does not envision individual motivation independently of other aspects; instead, it relates it to organization’s expectations, described through the idea of desirability function.

#### *Individual Desirability Function*

Desirability function was first introduced by Harrington (1965) as a strategy to optimize multiple response industrial processes. Since then, it has become very popular, either in the original or in a modified form, in the fields of process and products optimization and material selection (Akhazarova & Kafarov, 1982); however, the idea is very general in nature and, although nontechnological examples are uncommon, it can be applied, with little or no modifications, to any system with multiple characteristics. In the present paper the desirability function idea is applied to the individuals working in an organization in order to deal with their multiple motivation characteristics.

The individual desirability function  $d$  (Harrington, 1965) indicates how well the value of a certain characteristic of an individual fulfils the organization’s final expectations, that is, its degree of desirability. Function  $d$  can take on dimensionless values between 0 (for an absolutely undesirable value of the characteristic) and 1 (for the ideal value). The mathematical expression of  $d$  used in this work is given in Equation (1):

$$d = \exp\left(-\left(\left|\frac{X - X_{OPT}}{X_{OPT} - K}\right|\right)^N\right) \quad (1)$$

where  $X$  is the value of the characteristic expressed on a 1-8 score scale,  $K$  and  $N$  are two parameters defining the shape of the curve, and  $X_{OPT}$  is the value of the characteristic considered ideal, corresponding to  $d = 1$ . As this equation defines a curve symmetrical with respect to  $X_{OPT}$ , in order to represent the expected asymmetry of real desirability curves, two half-curves, named ascending (from  $X = 1$  to  $X = X_{OPT}$ , with parameters  $K_{ASC}$  and  $N_{ASC}$ ) and descending (from  $X = X_{OPT}$  to  $X = 8$ , with parameters  $K_{DESC}$  and  $N_{DESC}$ ) were “glued” to each other at the point  $X_{OPT}$ . Also, to allow the interpretation of individual desirability values, the 0-1 scale was divided into six intervals, as indicated in Table 2.

TABLE 2  
 Subdivision of individual and global desirability score range (0 to 1) in intervals

Numeric definition		
Interval	Representative value	Verbal description
0.80-1.00	0.900	Very good
0.63-0.80	0.715	Good
0.37-0.63	0.500	Sufficient
0.20-0.37	0.285	Insufficient
0.10-0.20	0.150	Poor
0.00-0.10	0.050	Very poor

Here  $d = 0.37$  is defined as the threshold of mere sufficiency, which separates the group of three intervals with sufficient or better desirability (sufficient+ group) from the group of three intervals with insufficient or worse desirability (insufficient– group). The definition of these intervals, although arbitrary, is essentially the same as that proposed by Harrington (1965), with the only difference that the original range 0.00-0.20 is divided into two intervals (0.00-0.10 and 0.10-0.20).

### Global Desirability Function

Since the participants are analyzed on the basis of multiple properties, it is useful to define a global desirability function  $D$  expressing how much the set of all properties is generally desirable. Like the  $d_i$ 's,  $D$  is also dimensionless and takes on values between 0 (*completely undesirable set*) and 1 (*ideal set*). The range 0-1 is divided in the same manner used for the individual desirability functions (see Table 2). The aggregate function adopted in this work is the power mean (Sheldon, 2004) in its weighted form reported in Equation (2):

$$D = \left( w_{Self} d_{Self}^\alpha + w_{Influence} d_{Influence}^\alpha + w_{Variation} d_{Variation}^\alpha + w_{Effectiveness} d_{Effectiveness}^\alpha + w_{Polarity} d_{Polarity}^\alpha \right)^{\frac{1}{\alpha}} \quad (2)$$

In this equation, the  $d_i$ 's are the five individual desirabilities to be aggregated and the  $w_i$ 's are the corresponding coefficients, subject to the constraints  $\sum_{i=1}^5 w_i = 1$ ,  $0 \leq w_i \leq 1$ , and  $-\infty \leq \alpha \leq +\infty$ . It was decided to adopt this particular aggregation operator instead of the more common arithmetic or geometric mean (which are both particular cases of the power mean for  $\alpha = 1$  and  $\alpha = 0$ , respectively), because the presence of the exponent  $\alpha$  allows the aggregate  $D$  to be calibrated, so as to ensure that the measurement scales for  $D$  and the  $d_i$ 's are the same. Coefficients  $w_i$  represent the relative importance (weight) attributed to each motivation dimension by the organization. Exponent  $\alpha$  can be made to correspond to a *compensation degree*  $c$  measuring, on a 0-1 scale, the degree of willingness of the organization to accept that a poor desirability score assigned to a certain dimension gets partly compensated by a good one assigned to a different dimension in the overall judgment. Dujmovic and Fang (2004) provide a conversion table between  $\alpha$  and  $c$ .

## Methodology

### Workshop

The workshop is a meeting — similar to a focus group — encompassing the participation of three to seven managers of the organization, together with a coordinator possessing the necessary skills. The managers are asked to express the organization's expectations about employee's motivation, which should be stated in form of shared judgments, based on organization's mission, vision, and values. The workshop comprises three sequential stages or procedures.

a) *Individual desirability functions*  $d_i$  (Stage 1). Here the participants in the workshop assign a desirability score ( $d$  variable) to each of the eight pure characters of each of the five motivation dimensions ( $X$  variable). The procedure for a certain dimension, for example, Self, is as follows. In the first instance each manager assigns the scores to each of the eight Self characters (extremely socializing ... extremely individualistic) according to her or his own view of what the organization's expectations are. Subsequently, these judgments become the object of a collegial negotiation aimed at defining shared values of precise (to two decimal figures) desirability scores for each character of Self dimension, and this procedure is repeated for each of the five motivation dimensions. Finally, the Harrington Equation (1) is fitted to the ( $X$ ,  $d$ ) data collected for each dimension, seeking the parameter values  $K_{ASC}$ ,  $N_{ASC}$ ,  $K_{DESC}$ , and  $N_{DESC}$  capable of minimizing the sum of squared errors. This procedure was implemented in an Excel VB macro using the MS Solver.

b) *Relative importance of the five dimensions of motivation* (Stage 2). A ranking of the relative importance of the five dimensions stems from an open discussion among the managers, aimed at jointly identifying the outcome that best fits the organization's point of view.

c) *Global desirability function*  $D$  (Stage 3). The last stage in the workshop is devoted to the estimation of the five  $w_i$  coefficients and the  $\alpha$  exponent of the aggregation model (global desirability function). This is an indirect process, where a number of hypothetical employees' profiles are submitted to the judgment of each manager and the whole group must reach a shared judgment after an open discussion. In order to simplify this task, only two levels of desirability were chosen, both for the individual dimensions (good or poor) and the global assessment (sufficient+ or insufficient-). The number of possible profiles is  $2^5$ ; however, it is not necessary to

evaluate them all because, as a consequence of the dimensions ordering carried out in procedure b), the judgments of many profiles can be logically and automatically inferred from those already examined. To this end, we developed an algorithm capable of identifying the shortest sequence of profiles which need to be evaluated: in fact, such a sequence cannot be formulated a priori because, after a certain profile has been selected for evaluation, the identity of the next one in the sequence depends on the assessment (good or poor) given to the above said profile and, as a consequence, it is necessary to proceed interactively. Once the profile's evaluation has been completed, the categorical results are translated into a numerical form, according to the representative values of the verbal categories reported in Table 2, that is:

$$d = \text{good} \rightarrow d = 0.715; \quad d = \text{poor} \rightarrow d = 0.15$$

$$D = \text{sufficient+} \rightarrow D \geq 0.37; \quad D = \text{insufficient-} \rightarrow D < 0.37.$$

The result is a nonlinear system of inequalities which, when applied to a suitable objective function to be optimized, can be solved by means of standard numerical methods, calculating the  $w_i$  coefficients and the  $\alpha$  exponent. The procedure adopted in the present work is MaxEntScores, a method already used in the field of psychometrics (Jessop, 2004) which ensures the minimal discrimination among individuals — a valuable precaution against a possibly biased manager's judgments. This method, which is based on maximizing the entropy of individual's characteristic scores (i.e., in the present case, of desirability scores) was implemented in a C++ program using the Levenberg-Marquardt numerical solution algorithm. The program submits the profiles to be judged one at a time and stops itself as soon as the number of answers necessary and sufficient to generate the aggregation model and to estimate the parameters has been collected.

### *Questionnaires for Employees*

In MotOr each dimension is measured through items in questionnaires administered to the organization's employees.

a) For the Primary Motivation (PM), which is a trait of the subject (and therefore not linked to specific situations like, for instance, the workplace), our choice was to rely on individual iconographic material, particularly suitable for projective dynamics. It has to be stressed that this approach is in line with several studies carried out in this field (Atkinson, 1964; McClelland, Clark, Lowell, & Atkinson, 1953; Murray, 1938; Rheinberg, 1995). The questionnaire, designated by letter A, presents itself in the form of comic strips in two versions. Indeed, the main character of the story is either feminine or masculine, since women tend to identify themselves with women and men with men. The respondents are given five booklets (one for each motivation dimension, but without any indication), containing, in random order, four stories each. Each story represents a grade of character in the dimension, and the final panel proposes three possible endings: one attenuating the grade, another maintaining it at the same level, and a last one in which the grade is enhanced. The respondent must spontaneously choose, according to her/his preference, one of the stories in each booklet, and then one of the possible endings. This gives a total range of 12 levels for each dimension.

b) For Rational Motivation (RM), which is also a trait of the subject, and for the Stated Behavior (SB), which is context-specific, and therefore linked to the workplace, the question-

naires (designated by letters B and C) are more traditional, based on the item-response technique and measured through scales of frequency (*always ... never*). Both questionnaires ask the respondent about the same kind of attitude, using the same questions, but refer to different contexts: the former to her/his preferences in her/his life (questionnaire B), and the latter to what she/he does in the workplace (questionnaire C). Each questionnaire contains 30 items (six for each of the five motivation dimensions), arranged in random order. In total, there are nine possible choices for each item, distributed on a frequency scale made up of five main measures (*always, often, sometimes, rarely, never*) and the four intermediate measures between them. In order to standardize the results, the scores of questionnaires A, B, and C are then normalized, assigning the values of 1 and 8 to the two extremes of the corresponding scales: consequently, the distance between two of the 12 grades of the questionnaire A is 0.637 units, and that between the nine grades of questionnaires B and C is 0.875 units.

### Test Development

MotOr was developed through intermediate versions (alpha and beta), an approach which allowed us to choose the best performing questionnaires items and to thoroughly develop the algorithms relative to the desirability and aggregation functions. The final version (Fin) was submitted to a validation process.

The alpha version was a pretest carried out within the University of Applied Sciences and Arts of Southern Switzerland (SUPSI), a Swiss vocational university: it was administered to 60 students (acting as employees) and, subsequently, to 30 teachers (also acting as employees), to five institute heads (acting as supervisors), and four members of the management staff (acting as managers and taking part in the workshop). The beta version was tested on seven working organizations (251 employees) chosen among the 10 partner organizations of the project, and the Fin version was used with the last three organizations (88 participants). It should be noted that the beta version differs from the Fin version only for the presence of an additional questionnaire (named D, see below) aimed at supervisors and intended for validation purposes only. Questionnaire D involved only subjects who did not participate in the workshop or in answering the questionnaires and therefore did not affect the rest of the test in any way: hence, the validation study performed in the beta version also serves as validation for the Fin version. The validation process of the questionnaires A, B, and C, which make up the Fin version, involved a total of 339 employees.

### Test Validation

We report here the procedures put in place in order to validate the methodology of measurement of motivation adopted in the test in terms of reliability and construct validity (Netermeyer, Bearden, & Sharma, 2003): the latter, in turn, requires a verification of unidimensionality and content validity. The validity study is based on the analysis of the answers given by the subjects to whom the test was administered in the beta and Fin stages.

Let's consider first Rational Motivation and Stated Behavior. In the following analysis we adopted the policy of excluding the participants in which the range of scores (*maximum-*

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*minimum*) of the six items related to a certain motivation dimension exceeds approximately twice the average value of the range calculated for all the participants (Hart & Hart, 1994): in fact, their answers can be reasonably considered inconsistent, maybe because of inadvertent errors, carelessness, or some other reason.

Unidimensionality and reliability were verified on the answers to the abovementioned questionnaires with the procedures of the item analysis (Cronbach's alpha and item-to-total correlations) and, respectively, principal component analysis (PCA). Content validity was verified on the basis of the supplementary questionnaire D, aimed at supervisors of employees who took the test and designed to measure the behavior of the latter. This questionnaire is substantially identical to questionnaire C, except for two specific characteristics: first, questions are worded in the third person ("What does he do during the working time?" ... "He does ...") and, secondly, there is an additional question which asks the supervisor to assign an overall judgment score on eight possible levels (the same as indicated in Table 1) to each employee's behavior for each of the five motivational dimensions. The supervisor is asked, thinking about each of his coworkers in turn (but without identifying her/him in any way on the questionnaire) both to answer each item and to assign the overall judgment score. The basic idea is that if the individual item actually expresses the assumed motivational content, a significant correlation between the item scores (predictor variables *X*) and the overall judgment scores (criterion variable *Y*) should exist within each dimension. Note that, since employees have to remain anonymous, the existence of such a correlation is sought solely within the supervisor's answers. The results were analyzed by the method of partial least squares (PLS) multivariate regression (for a review see Wold, Sjöström, & Eriksson, 2001). Strictly speaking, these results apply to SB (questionnaire C); however it seems reasonable to assume that the validity of RM is also proved, since the items constituting the correspondent questionnaire (B) are essentially the same. The results of the validation study for RM and SB are shown in Tables 3 and 4.

The results of the reliability and unidimensionality studies are reported in Table 3. The first block of data shows the number of removed outliers (out of the 88 initial cases), which turns out to be reasonable, that is, four on average for each of the five motivation dimensions. The second block shows the item-to-total correlations: all values are acceptable according to the criterion requiring at least 50% of them to be in the range 0.3-0.7 (Carmines & Zeller, 1979), except those of RM of Self (where the range is 0.76-0.81), suggesting a certain degree of redundancy in this case; however, as this same criterion is met for SB of Self, it was decided to accept them. The third block shows the Cronbach's alpha values: here all values range from 0.71 to 0.94 and therefore exceed the minimum acceptance criterion of 0.70 suggested by Nunnally (1994) except SB of Effectiveness which, however, is only slightly lower (0.69): it is therefore considered reasonable to accept it as well. On the whole, the data collected demonstrate a sufficient reliability of the measurement of RM and SB. The fourth and fifth blocks refer to the verification of unidimensionality through the use of the PCA method. The fourth block shows the percentage of variance explained by the principal components: the first component (PC1) is by far the most important for all 10 measurements, accounting for 40-76% of the variance, depending on the case. The fifth block reports the loadings of the PCA models, and confirms these results: in fact, in all cases the PC1 loadings relative to the six items have the same algebraic sign, while this does not happen in the PC2 case. In conclusion, it can be stated that unidimensionality is substantially verified for all 10 measurements.

TABLE 3  
Verification of reliability and unidimensionality for RM and SB

Motivation dimension		Self		Influence		Variation		Effectiveness		Polarity	
Type		RM	SB	RM	SB	RM	SB	RM	SB	RM	SB
Number of removed outliers		5	3	4	3	8	6	3	3	1	4
Item-to-total correlations	Item 1	0.77	0.85	0.51	0.38	0.43	0.68	0.48	0.41	0.43	0.55
	Item 2	0.86	0.71	0.56	0.55	0.45	0.67	0.49	0.40	0.52	0.49
	Item 3	0.85	0.78	0.63	0.58	0.45	0.69	0.52	0.44	0.53	0.50
	Item 4	0.83	0.69	0.63	0.45	0.30	0.54	0.65	0.52	0.68	0.76
	Item 5	0.76	0.66	0.64	0.55	0.52	0.69	0.41	0.44	0.47	0.54
	Item 6	0.81	0.69	0.70	0.64	0.47	0.60	0.62	0.37	0.66	0.77
Cronbach's alpha		0.94	0.90	0.84	0.78	0.71	0.86	0.77	0.69	0.80	0.82
% explained variance PCA	PC1	76.24	67.99	55.27	47.98	40.79	58.43	47.84	40.23	49.84	54.60
	PC2	8.52	11.11	15.24	20.19	24.75	11.92	18.14	19.17	16.31	15.17
	PC3	5.43	8.04	10.29	12.43	12.33	9.32	12.47	15.75	11.52	11.99
	PC4	3.76	6.61	8.66	9.34	9.19	8.75	10.47	11.04	9.64	8.77
	PC5	3.38	4.72	6.70	5.76	6.92	7.16	6.38	7.54	6.65	5.87
	PC6	2.67	2.52	3.83	4.31	6.01	4.43	4.69	6.27	6.04	3.60
PCA loadings PC1; PC2	Item 1	-0.40; -0.56	-0.45; 0.23	-0.36; 0.43	-0.33; 0.51	-0.41; 0.46	-0.42; 0.14	-0.39; 0.24	-0.40; -0.09	-0.34; -0.57	-0.38; -0.50
	Item 2	-0.43; -0.18	-0.40; -0.36	-0.38; -0.45	-0.42; -0.17	-0.41; 0.43	-0.42; -0.28	-0.40; 0.53	-0.40; 0.36	-0.39; -0.49	-0.36; 0.61
	Item 3	-0.42; 0.27	-0.43; 0.13	-0.42; -0.40	-0.44; -0.49	-0.42; 0.27	-0.43; -0.03	-0.41; 0.22	-0.43; 0.45	-0.39; 0.13	-0.36; -0.52
	Item 4	-0.41; 0.40	-0.39; -0.30	-0.42; 0.40	-0.36; 0.40	-0.30; -0.48	-0.36; -0.71	-0.46; -0.34	-0.44; -0.54	-0.47; 0.08	-0.48; 0.24
	Item 5	-0.39; -0.44	-0.38; 0.72	-0.42; -0.39	-0.42; -0.44	-0.46; -0.31	-0.43; 0.22	-0.32; -0.71	-0.40; -0.49	-0.37; 0.62	-0.38; -0.14
	Item 6	-0.41; 0.47	-0.39; -0.44	-0.45; 0.39	-0.46; 0.34	-0.43; -0.44	-0.39; 0.59	-0.46; -0.02	-0.38; 0.35	-0.47; 0.14	-0.48; 0.19

Note. RM = Rational Motivation; SB = Stated Behavior; PCA = principal component analysis.

Table 4 shows the results of the study of content validity carried out by the PLS method for the SB measurements. The first block of data shows the number of removed outliers; the second shows that the first factor explains a reasonably high fraction of  $X$  variance (37%-60% depending on the case), and the third contains the  $X$  loadings. It is noteworthy that the  $X$  loadings of the first factor are all positive and fairly high in absolute value (0.32 to 0.48), while those of the second factor are partly positive and partly negative: this means that, for the measurement of SB, a significant positive correlation between the global ( $Y$  variable) and the detailed ( $X$  variables) judgment scores expressed by supervisors exists, which results from a fairly even contribution from all the items. It can therefore be concluded that the measurements of SB (and also, according to the considerations already stated, those of RM) do have content validity. Summarizing, as unidimensionality for both RM and SB have already been demonstrated, we can state that construct validity for these measurements is also verified.

TABLE 4  
 Verification of construct validity for SB

Motivation dimension	Self	Influence	Variation	Effectiveness	Polarity	
Number of removed outliers	2	4	8	6	8	
% explained $Y$ variance PLS	PC1	44.17	54.46	58.86	36.73	59.56
	PC2	10.14	4.52	0.83	10.38	3.45
	PC3	0.65	0.15	0.16	0.76	0.14
	PC4	0.19	0.03	0.02	0.01	0.13
	PC5	0.00	0.00	0.00	0.00	0.05
	PC6	0.00	0.00	0.00	0.00	0.40
PLS $X$ loadings PC1; PC2	Item 1	0.35; 0.10	0.33; -0.02	0.38; -0.19	0.35; 0.49	0.39; -0.57
	Item 2	0.32; -0.61	0.42; 0.54	0.43; 0.14	0.40; -0.58	0.39; 0.37
	Item 3	0.44; -0.58	0.43; 0.03	0.48; 0.33	0.42; 0.38	0.40; 0.05
	Item 4	0.48; 0.66	0.43; -0.84	0.44; -0.71	0.41; 0.17	0.39; 0.62
	Item 5	0.38; 0.12	0.41; -0.02	0.37; 0.64	0.43; -0.04	0.44; -0.45
	Item 5	0.47; -0.11	0.43; 0.18	0.34; -0.29	0.46; -0.55	0.44; -0.06

Note. PLS = partial least squares; PC = principal component.

As far as Primary Motivation is concerned, it should be noted that for a projective-type approach, such as that pertaining to the PM questionnaire, the use of canonical validation methods, particularly for reliability, does not seem appropriate (Atkinson, 1981, 1982). For validity, however, it is possible to proceed with content validation methods.

A panel of 15 judges was presented with the five booklets of four pages each making up the PM test, with the task of assigning one of the five motivation dimensions to each booklet and one of the four grades to each page. The results, as Table 5 shows, can be considered satisfactory: in fact, all of the dimensions were correctly identified. The grades of each dimension, in general,

were also clearly identified, except four intermediate ones, that is, “Slightly material” and “Slightly conceptual” (Effectiveness) and “Slightly constructive” and “Slightly eliminative” (Polarity), which were inverted by some judges.<sup>1</sup> According to the above results, it can be stated that the content validity of the PM is proven.

TABLE 5  
 Verification of content validity for PM (percent of correct recognition by judges)

Dimension	Dimension	Grade 1	Grade 2	Grade 3	Grade 4
Self	100%	100%	100%	100%	100%
Influence	100%	100%	100%	100%	100%
Variation	100%	100%	100%	100%	100%
Effectiveness	100%	100%	87%	87%	100%
Polarity	100%	100%	87%	87%	100%

#### Software

The methodology described in this work was implemented into a Java software package (MotOr V. 1.0),<sup>2</sup> equipped with all the necessary features related to data security and test management. It allows the test to be carried out in the online modality, which reduces the possibility of errors, makes the collection of data easier and speeds up the data processing. The program implements all phases of the test: carrying out the workshop, defining individual and global desirability functions, printing all the questionnaires and storing the data. Once all the employees have completed the test, the software automatically performs the necessary calculations and statistical analyses and produces a self-compiled report consisting of a standard text completed by the results obtained throughout the specific study (tables and graphs). In order to complete the report, the coordinator adds the pertinent comments relating to each motivation dimension, the overall results in relation to the expectations of the organization and, of course, the conclusions in verbal form: the final outcome is similar to that of the case study presented below.

#### A CASE STUDY

As an example of application of test MotOr, we present here the case of a Swiss company operating in the field of retail. According to a specific request from the organization, the study exclusively refers to employees of the non-food sales departments. Five managers (in the workshop) and 36 employees (to whom the questionnaires were administered) took part in the study.

#### Workshop

Following procedure (a) of the workshop, the managers of the organization negotiated and selected the profiles relative to the individual desirability functions of the five motivation dimensions: the curve corresponding to the dimension of Self is reported here as an example (Figure 1).

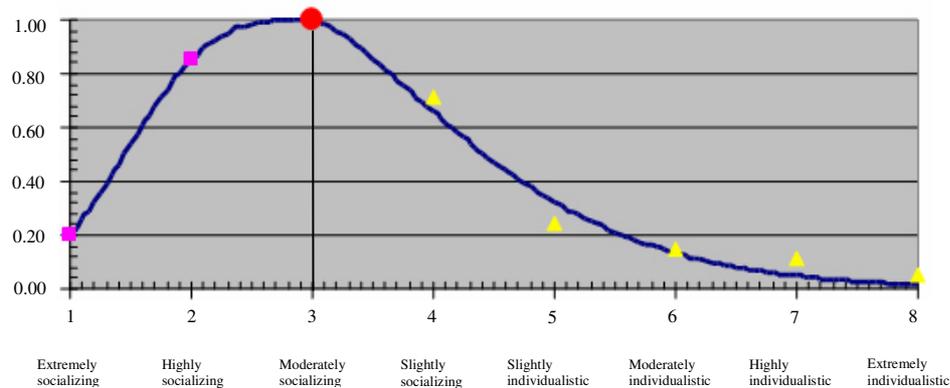


FIGURE 1  
An example of individual desirability function for the motivation dimension of Self.  
Verbal description of characters are displayed according to Table 1.

Note that, in this case, the curve shows a preference for a moderately socializing form of motivation. The individual desirability curves for the other four motivation dimensions are not shown here; it is relevant, however, to summarize the ideal character of each of them (with the corresponding score, shown in parentheses): Self: moderately socializing (3); Polarity: moderately constructive (3); Variation: moderately innovative (3); Effectiveness: slightly conceptual (5); Influence: slightly dominant (4).

The application of procedure (b) during the workshop provided the following order of importance of the dimensions of motivation (from most to least important): 1. Self; 2. Polarity; 3. Variation; 4. Effectiveness; 5. Influence. In order to define the global desirability function, the organization's managers carried out the workshop procedure (c). In this case, it meant that they were required to evaluate a sequence of eight profiles of hypothetical employees, as documented in Table 6.

TABLE 6  
The profiles of hypothetical employees, described by their individual desirabilities (columns from 2 to 6) submitted to the judgment of the organization's management (column 7)

Profile	Self	Polarity	Variation	Effectiveness	Influence	Global judgment
1	Good	Poor	Poor	Good	Poor	Insufficient-
2	Poor	Good	Good	Poor	Good	Insufficient-
3	Good	Good	Poor	Poor	Good	Insufficient-
4	Good	Good	Good	Good	Poor	Sufficient+
5	Good	Good	Poor	Good	Poor	Insufficient-
6	Good	Poor	Good	Good	Good	Insufficient-
7	Good	Good	Poor	Good	Good	Sufficient+

Based on these results, all the parameters of the power mean defining the global desirability function according to Equation (2) can be calculated, resulting in the following model:

$$D = \left( 0.3136d_{Self}^{-1.1657} + 0.2440d_{Polarity}^{-1.1657} + 0.2191d_{Variation}^{-1.1657} + 0.1510d_{Effectiveness}^{-1.1657} + 0.0722d_{Influence}^{-1.1657} \right)^{\frac{1}{1.1657}}$$

This equation shows that, if the smallest  $w_i$  is set to 1.00, the relative importance of the motivation dimensions are: Self = 4.34, Polarity = 3.38, Variation = 2.92, Effectiveness = 2.09, and Influence = 1.00. Furthermore, the value of  $\alpha = -1.1657$  shows that the organization adopts de facto a relatively low compensation degree ( $c = 0.215$  on a 0-1 scale) in its judgments.

### Results

The results obtained from the administration of questionnaires to the employees are presented and discussed below. It should be noted that not all the 36 employees who took part in the test provided valid responses to all of the items: more precisely, the number of valid respondents were 28 for PM, 32 for SB, and 34 for RM. First of all, the analysis of questionnaires yielded the mean score values of PM, RM, and SB for each of the five motivation dimensions, which are summarized in Table 7.

TABLE 7  
 Average scores expressed by the individual employees in questionnaires  
 A (PM), B (RM), and C (SB), and corresponding characters for each dimension of motivation

	Self		Polarity		Variation		Effectiveness		Influence	
	Average score	Character	Average score	Character	Average score	Character	Average score	Character	Average score	Character
PM	3.3	Moderately socializing	2.9	Moderately constructive	3.6	Slightly innovative	4.6	Slightly conceptual	4.7	Moderately subordinate
RM	3.5	Moderately socializing	3.0	Moderately constructive	3.7	Slightly innovative	4.0	Slightly materialist	3.3	Moderately dominant
SB	3.1	Moderately socializing	2.7	Moderately constructive	3.6	Slightly innovative	3.7	Slightly conceptual	3.4	Slightly subordinate

Note. PM = Primary Motivation; RM = Rational Motivation; SB = Stated Behavior.

Subsequently, the individual desirabilities  $d_i$ 's for each employee were calculated by plugging the mean scores of each motivation dimension into the Harrington equation and projected onto the corresponding individual desirability curves, thus providing a graphical representation of the results. In this way, the graphical representations of PM, RM, and SB for each of the five motivation dimensions are obtained. To illustrate what these graphs look like, the representation of PM for the dimension of Self is given in Figure 2 as an example. The horizontal and the vertical axes express the eight basic characters defined in Table 1 and the six desirability inter-

vals defined in Table 2, respectively; each point may represent one or more participants, as indicated by the numbers next to them.

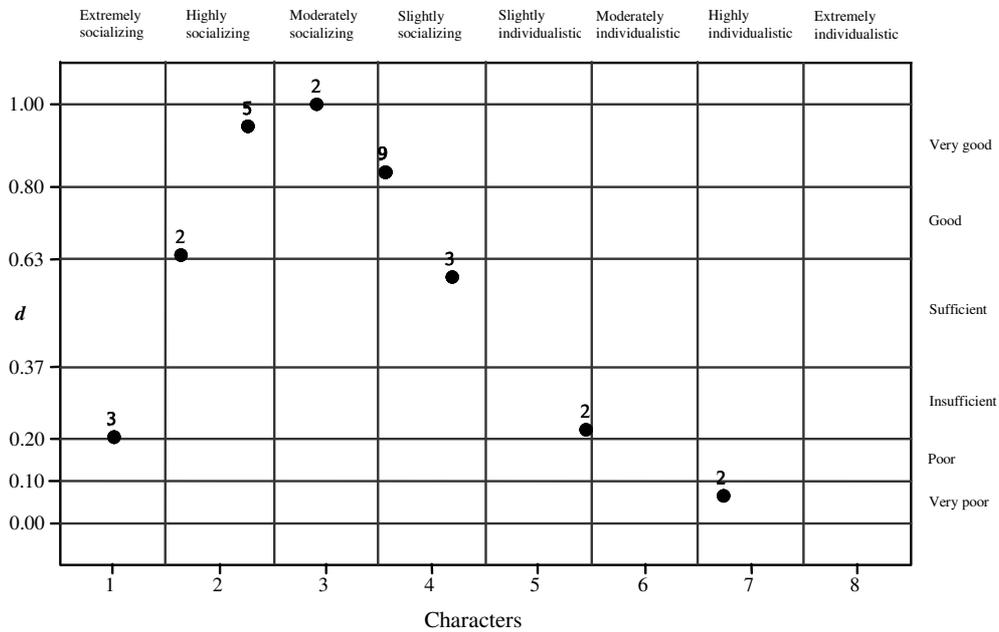


FIGURE 2  
An example of graph of individual desirability of employees versus characters for the motivation dimension of Self – Primary Motivation. Verbal description of characters and desirability intervals are displayed according to Tables 1 and 2, respectively.

A numerical summary of the results is given in Table 8, where the average values of individual desirabilities  $d_i$ 's are reported. As this table shows, all of the values lie in the interval  $0.63 < d < 0.89$  (good or very good), even if they turn out to be somewhat lower for PM than for RM and SB: this means that the employees' motivation matches rather well, on the whole, the organization's expectations.

TABLE 8  
The average values of individual desirabilities  $d_i$ 's expressed by the employees in questionnaires A (PM), B (RM), and C (SB), and the correspondent verbal judgments for each dimension of motivation

	Self		Polarity		Variation		Effectiveness		Influence	
	$d$	Judgment	$d$	Judgment	$d$	Judgment	$d$	Judgment	$d$	Judgment
PM	0.66	Good	0.70	Good	0.71	Good	0.63	Good	0.69	Good
RM	0.74	Good	0.76	Good	0.79	Good	0.89	Very good	0.74	Good
SB	0.81	Very good	0.81	Very good	0.75	Good	0.85	Very good	0.74	Good

Note. PM = Primary Motivation; RM = Rational Motivation; SB = Stated Behavior.

Finally, individual desirabilities were used to calculate global desirabilities. In fact, although individual desirabilities contain all the information necessary to allow the assessment of the degree of consistency between employee's motivation and organization's expectations and could therefore be used for this purpose, a direct use of these data may be difficult because employees' motivation is measured over three domains (PM, RM, and SB), and each domain over five dimensions (Self, Influence, Effectiveness, Variation, and Polarity). Instead, organization's expectations are obviously expressed just over the cited five dimensions tout court. This problem was solved by aggregating the values of the individual desirabilities of the five dimensions into one global desirability score using Equation (2), which provides one global desirability score for PM, one for RM, and one for SB. As a result, this procedure offers a simple way to characterize the motivation of employees in an organization and opens the way to administer MotOr in future and compare the results with the current ones.

Figures 3, 4, and 5 display the values of global desirabilities for PM, RM, and SB, respectively, versus organization's employees' identification order; the connecting segments do not have a specific meaning; their only purpose is to facilitate the understanding of the graphs. In this way it is possible to immediately visualize the situation of any employee, in spite of the fact that her/his identity is unknown. In the present case, the global desirability turns out to be generally satisfactory for RM (four employees are evaluated as insufficient- and 30 as sufficient+, 20 of whom as good or very good) and for SB, with two employees evaluated as insufficient- and 30 as sufficient+ (26 of which as good or very good). The situation for PM is less satisfactory; in fact, 13 employees are evaluated as insufficient- and 15 as sufficient+ (11 of which as good or very good).

It is interesting to take into account the values of global desirabilities of the individual employees in detail. Looking at Figures 3, 4, and 5, it can be noticed that a subject who gets a satisfactory evaluation for RM tends to get also a satisfactory evaluation for SB and, although in a less clear-cut way, for PM.

Focusing on those employees who get more undesirable results, the following situation can be depicted (references are made to the employee's ID number and to the values of global desirabilities put in parentheses after it):

- three insufficient evaluations: employee 34: poor desirabilities, both at the motivation and SB levels, with  $D(RM) = 0.12$ ;  $D(SB) = 0.11$ ; and  $D(PM) = 0.01$ , and employee 6, with  $D(RM) = 0.14$ ;  $D(SB) = 0.32$ ; and  $D(PM) = 0.36$  (however note that the latter figure is just below sufficiency);
- two insufficient evaluations: employee 10: poor desirabilities at the motivation level, with  $D(RM) = 0.22$ ;  $D(SB) = na$ ; and  $D(PM) = 0.32$ ;
- one insufficient evaluation and two barely sufficient evaluations: employee 8, who shows a poor desirability for PM and just above sufficiency desirabilities for RM and SB, with  $D(RM) = 0.47$ ;  $D(SB) = 0.48$ ; and  $D(PM) = 0.13$ .

It should be noted that all other cases with one insufficient evaluation (all for PM) exhibit good or very good evaluations for RM and SB: this probably indicates some predominance of RM over PM at the behavior level, at least judging on the basis of subjects statements.

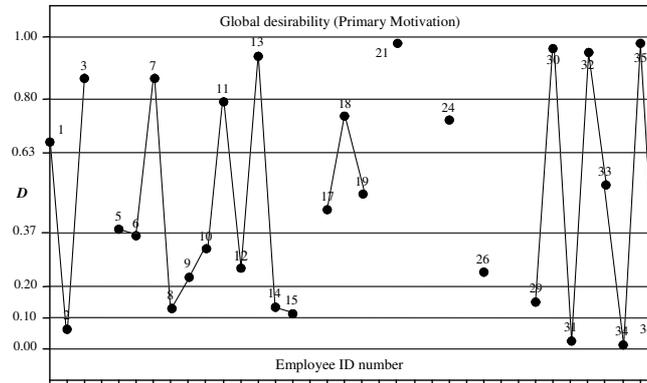


FIGURE 3

Graph of global desirability (Primary Motivation) of employees versus employees' identification number. The eight missing points correspond to respondents who failed to provide valid answers to each of the questions of questionnaire A.

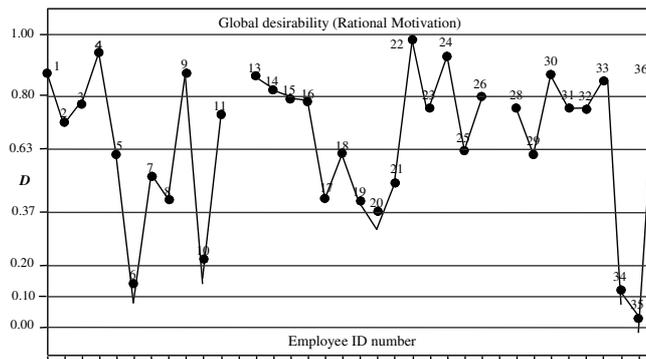


FIGURE 4

Graph of global desirability (Rational Motivation) of employees versus employees' identification number. The two missing points correspond to respondents who failed to provide valid answers to each of the questions of questionnaire B.

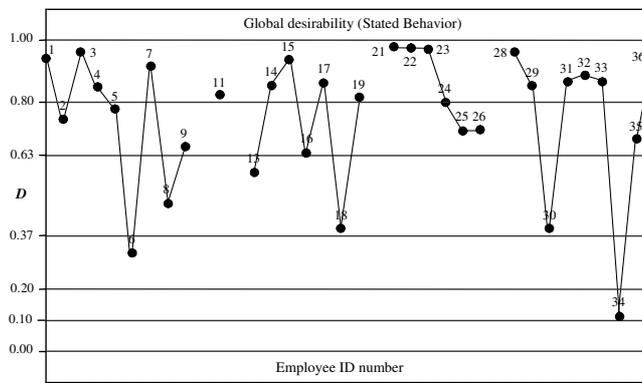


FIGURE 5

Graph of global desirability (Stated Behavior) of employees versus employees' identification number. The four missing points correspond to respondents who failed to provide valid answers to each of the questions of questionnaire C.

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## DISCUSSION AND CONCLUSIONS

This work describes a novel psychological test, named MotOr which, resorting to the traditional psychometric tools (questionnaires and collection of information by means of interviews), elaborates the results in terms of desirability of employees' motivation and behavior with respect to organization's expectations.

In fact, its "relativistic" view of motivation is actually the most distinctive feature of the test, since, after a wide search on the published literature, it was not possible to find anything analogous: the only research found with some points in common with the present study is the one conducted by Ilardi, Leone, Kasser, and Ryan (1993). MotOr's manager workshop is clearly an added value factor, since it leads the organization to reflect deeply on its own values and expectations. Further, with its analysis of Primary Motivation, MotOr highlights not only the explicit motives, but also the implicit ones: this is a rather innovative feature, in line with the need to get a more complete view on employee motivation postulated, that is, by Kanfer (2009).

The test was run in several organizations operating in various fields, both in the private and public sectors, always experiencing a good acceptance by the managers and employees. Managers found the meaning of the five motivation dimensions (Self, Influence, Effectiveness, Variation, and Polarity), the concepts of Primary Motivation, Rational Motivation, and Stated Behavior and the test results easy to understand. Also, apparently, employees did not find it difficult to appropriately complete the test.

The test has also some limitations. Firstly, like other similar multidimensional devices (McAdams, 1992; McCrae & John, 1992), it is built on the idea of trait, a concept whose validity is called into question by some scholars (Mischel, 1973). Moreover, the five dimensions of the test may be not exhaustive with respect to the subject's personality and it could be argued that more fine-grained definitions (McAdams, 1992) could be included. Finally, SB can be clearly influenced by environmental aspects like, for instance, the organizational culture and, since its results are based on subject's perceptions, they may differ from the actual situation.

In conclusion, MotOr represents altogether a useful and promising strategic tool for the management of human resources and for the study of organizational changes, giving therefore some valuable advantages to organizations in the management of their employees. Here is a list of possible applications in the real managerial practices: (1) the definition of the needs of the organization in terms of five important psychological dimensions linked to the exercise of the professional activity; (2) the comparison of employees' motivation with the personalized needs of every organization; (3) the measurement of the status quo of motivation with a comprehensive tool, including explicit and implicit motives; (4) the possibility to use the test both for employees' management and personnel hiring; (5) the possibility to repeat the test administration and manager workshop over the years, giving a longitudinal view of the situation and revealing tendencies of improvement, stagnation, and deterioration; (6) the possibility, with the collaboration of the interested organizations, to set up databases intended to compare the individual organization's results within the collected cumulative data of specific activity sectors; (7) the use of a dedicated software which does not require the presence of a psychologist for the administration of the test, the data analysis, and the presentation of results.

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## NOTES

1. Efforts will be made to modify the comic strips presentation in order to improve the validation results in future versions of the test.
2. This part of the present work was carried out after the end of project MotOr, within a new project called "MotOr2," funded by Vocational Division of the Department of Education, Culture, and Sport (DECS), Bellinzona, Switzerland.

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## REFERENCES

- Akhnazarova, S., & Kafarov, V. (1982). *Experiment optimization in chemistry and chemical engineering*. Moscow, Russia, and Chicago, IL: MIR publishers.
- Allen, V. L., & Greenberger, D. B. (1980). Destruction and perceived control. In A. Baum & J. Singer (Eds.), *Advances in environmental psychology. Applications of personal control* (Vol. 2, pp. 85-109). New York, NY: Psychology Press.
- Allport, G. W. (1955). *Becoming: Basic considerations for a psychology of personality*. New Haven, CT: Yale University Press.
- Atkinson, J. (1964). *An introduction to motivation*. Princeton, NJ: Van Nostrand.
- Atkinson, J. (1981). Studying personality in the context of an advanced motivational psychology. *American Psychologist*, 36, 117-128. doi:10.1037/0003-066X.36.2.117
- Atkinson, J. (1982). Motivational determinants of thematic apperception. In A. Stewart (Ed.), *Motivation and society* (pp. 3-40). San Francisco, CA: Jossey-Bass.
- Carmines, E., & Zeller, R. (1979). *Quantitative applications in the social sciences*. Beverly Hills, CA: Sage.
- Deci, E., & Ryan, R. (1985). *Intrinsic motivation and self-determination in human behaviour*. New York, NY: Plenum Press.
- Digman, J. M. (1990). Personality structure: Emergence of the five-factor model. *Annual Review of Psychology*, 41, 417-440. doi:10.1146/annurev.ps.41.020190.002221
- Dujmovic, J. J., & Fang, W. Y. (2004). Reliability of LSP criteria. In V. Torra & Y. Narukawa (Eds.), *Modeling decisions for artificial intelligence. First international conference, MDAI, Barcelona. August 2004* (pp. 151-162). Berlin-Heidelberg, Germany: Springer-Verlag.
- Epstein, S. (1994). Integration of the cognitive and the psychodynamic unconscious. *American Psychologist*, 49, 709-724. doi:10.1037/0003-066X.49.8.709
- Freud, S., & Einstein, A. (2010). *Why war? Albert Einstein's 1932 letter to Freud's response*. New York, NY: Sequoia Free Press.
- Harrington, E. C. (1965). The desirability function. *Industrial Quality Control*, 21, 494-498.
- Hart, M., & Hart, R. F. (1994). The evaluation of a measurement system. *Production and Inventory Management Journal*, Fourth Quarter, 22-26.

- Hough, L. M., & Oswald, F. L. (2008). Personality testing and industrial-organizational psychology: Reflections, progress, and prospects. *Industrial and Organizational Psychology, 1*, 272-290. doi:10.1111/j.1754-9434.2008.00048.x
- Ilardi, B. C., Leone, D., Kasser, T., & Ryan, R. M. (1993). Employee and supervisor ratings of motivation: Main effects and discrepancies associated with job satisfaction and adjustment in a factory setting. *Journal of Applied Social Psychology, 23*, 1789-1805. doi:10.1111/j.1559-1816.1993.tb01066.x
- Jessop, A. (2004). Minimally biased weight determination in personnel selection. *European Journal of Operational Research, 153*, 433-444. doi:10.1016/S0377-2217(03)00163-2
- John, O. P., & Srivastava, S. (1999). The Big-Five trait taxonomy: History, measurement, and theoretical perspectives. In L. Pervin & O. P. John (Eds.), *Handbook of personality: Theory and research* (pp. 102-138). New York, NY: Guilford.
- Jung, C. G. (1976). *Psychological types*. Princeton, NJ: Princeton University Press.
- Kanfer, R. (2009). Work motivation: Identifying use inspired research directions. *Industrial and Organizational Psychology, 2*, 77-93.
- Lewin, K. (1935). *A dynamic theory of psychology*. New York, NY: McGraw-Hill.
- Lewin, K. (1936). *Principles of topological psychology*. New York, NY: McGraw-Hill.
- Lorr, M., & Knight, L. A. (1987). Higher order factors assessed by the ISI and PRF. *Journal of Clinical Psychology, 43*, 96-99. doi:10.1002/1097-4679(198701)43:1<96::AID-JCLP2270430114>3.0.CO;2-K
- McAdams, D. P. (1992). The five factor model in personality: A critical appraisal. *Journal of Personality, 60*, 329-361. doi:10.1111/j.1467-6494.1992.tb00976.x
- McClelland, D., Clark, R., Lowell, E., & Atkinson, J. (1953). *The achievement motive*. New York, NY: Appleton Century Crofts.
- McClelland, D., Koestner, R., & Weinberger, J. (1989). How do self-attributed and implicit motives differ? *Psychological Review, 96*, 690-702. doi:10.1037/0033-295X.96.4.690
- McCrae, R. R., & John, O. P. (1992). An introduction to the five factor model and its applications. *Journal of Personality, 60*, 175-215. doi:10.1111/j.1467-6494.1992.tb00970.x
- Mischel, W. (1973). Toward a cognitive social learning reconceptualization of personality. *Psychological Review, 80*, 252-283. doi:10.1037/h0035002
- Murray, H. (1938). *Explorations in personality*. New York, NY: Oxford University Press.
- Netermeyer, R. G., Bearden, W. O., & Sharma, S. (2003). *Scaling procedures*. Los Angeles, CA: Sage Publications.
- Nunnally, J. C. (1994). *Psychometric theory*. New York, NY: McGraw-Hill.
- Oreg, S. (2003). Resistance to change: Developing an individual differences measure. *Journal of Applied Psychology, 88*, 680-693. doi:10.1037/0021-9010.88.4.680
- Ostinelli, G. (2005). *Motivazione e comportamento* [Motivation and behavior]. Trento, Italy: Erickson.
- Rheinberg, F. (1995). *Motivation*. Stuttgart, Germany: Kohlhammer Druckerei.
- Roeser, R. (2004). Competing schools of thought in achievement goal theory. In M. L. Maehr & P. R. Pintrich (Eds.), *Advances in motivation and achievement. Motivating students, improving schools* (Vol. 13, pp. 265-300). Amsterdam, The Netherlands: Elsevier.
- Ryan, R., & Connell, J. (1989). Perceived locus of causality and internalization: Examining reasons for acting in two domains. *Journal of Personality and Social Psychology, 57*, 749-761. doi:10.1037/0022-3514.57.5.749
- Sheldon, N. (2004). The generalized mean. *Teaching Statistics, 26*, 24-25. doi:10.1111/j.1467-9639.2004.0141a.x
- Stewart, A. (1992). Self-definition and social definition: Personal styles reflected in narrative style. In C. Smith (Ed.), *Handbook of thematic content analysis* (pp. 481-488). Cambridge, UK: Cambridge University Press.
- Sueki, H., & Eichenberg, C. (2012). Suicide bulletin board systems comparison between Japan and Germany. *Death Studies, 36*, 565-580. doi:10.1080/07481187.2011.584012
- Weiner, B. (1990). History of motivational research in education. *Journal of Educational Psychology, 82*, 616-622. doi:10.1037/0022-0663.82.4.616
- Weiner, B. (1992). *Human motivation*. Newbury Park, CA: Sage.
- Wold, S., Sjöström, M., & Eriksson, L. (2001). PLS-regression: A basic tool of chemometrics. *Chemometrics and Intelligent Laboratory Systems, 58*, 109-130. doi:10.1016/S0169-7439(01)00155-1