

PREDICTION OF BEHAVIOUR IN THE NATURAL SETTING

Michael Reicherts

University of Fribourg, Switzerland

Meinrad Perrez

University of Fribourg, Switzerland

Different types of psychological prediction are distinguished: rational predictions referring to empirically founded indicators as in many trait conceptions, and causally founded predictions referring to a situation-behavior theory. In an empirical study the predictability of stress and coping behavior of $N=60$ students is analysed under specific conditions: (a) on the basis of behavioral data recorded in field situations (stressful daily life episodes) and (b) referring to some characteristics of these situations as perceived by the subject - both recorded by a pocket computer aided self-observation procedure. Emotional and coping behavior is predicted (1) deriving from global and situation-specific tendencies in the period before and (2) deriving from a situation-behavior theory of stress and coping which connects the perceived situational characteristics as antecedents with behavior properties as consequents (lawful prediction). The results of the different predictions are evaluated and discussed.

INTRODUCTION

The idea of the predictability of behavior presupposes the lawfulness of behavior. The mainstreams of research on trait-based approaches during the last decades were concentrated on questions concerning longitudinal consistency (=stability) and cross-situational consistency. Magnusson & Endler (1977) differentiated the latter by distinguishing reaction to similar vs. dissimilar situations. A statistical paradigm, factor analysis, largely oriented the whole approach along with the later analysis of variance model after the concept of situationperson-interaction had been introduced. In addition to the orientation on certain statistical methods was the preponderant orientation on Q-Data.

Hempel (1965) analysed the logical structure of prediction in terms of the syllogism of causal explanation. For causal explanation and causally founded prediction knowledge on the lawfulness of behavior is a *conditio sine qua non*. Causally founded predictions are distinguished from rational predictions (Stegmüller, 1983). For the latter only empirically confirmed correlations between antecedent indicators or symptoms and the predicted behavior are needed. Hence, the values of a theory-less questionnaire may predict some later behavior probabilities of a person or a group. We call this kind of prediction 'blind' prediction. Some of the prediction approaches by general dispositions (traits) and by situation-person interaction belong to this prediction family. On the other hand, causally founded predictions are deduced or induced from confirmed laws of behavior and diagnostically proven antecedent conditions.

We try to analyse the predictability of certain types of behavior (a) in the context of certain hypotheses concerning the influence of situational parameters on behavior as perceived by the subject, and (b) on the basis of computer-aided self observational data in the field. The underlying theory postulates that the perception of controllability, changeability and valence of the stressful situation is a relevant antecedent condition for coping behavior. Controllability is defined as the subjective probability that a situation is able to be influenced by the person's best available reaction. Changeability is defined as the subjective probability that a situation will change by its own dynamic. The following lawful hypotheses give the 'nucleus' of the theory (Perrez & Reicherts, 1986):

(1) The higher the perceived controllability of a situation in relation to its changeability (the 'net' control) and the higher the valence, the more we expect active influence on the situation as coping behavior.

(2) The more controllability equals the changeability, and the more the overall chance of a positive outcome for the situation approximates 50/50, the stronger the tendency to stay passive (hesitation or resignation).

(3) The lower the overall chance of a positive outcome (the 'gross' control), the stronger the tendency to escape or avoid. Also, the more negative the valence of the situation, given a low or middle controllability value, the higher the probability for evasive coping behavior. We will analyse predictability of behavior sub specie of these theoretical assumptions and we will compare the results obtained with predictions without theoretical assumptions.

Method

We developed a computer-aided method to record behavior which allows reliable self-observation and reporting of certain ecological and

psychological variables of situation-behavior-episodes under field conditions (Perrez & Reicherts, 1987). The pocket computer system (Sharp PC 1360, programs written in BASIC) allows highly structured descriptions of real stress encounters and helps to reduce the time lag between the experience of the stressful situation and its recording. This method of self-observation on several real life occasions seems to lie somewhat between pure Q-Data and L-Data.

The description of situational characteristics includes a free description of the situation; it also includes subjective ratings of the valence (i.e. the degree of infringement), the controllability and changeability of the situation, and of other situational characteristics. Emotional experience is also rated using six different dimensions (e.g. fearful, depressed). Coping operations are differentiated into two groups: self-directed intrapsychic (palliation, reevaluation, self blame etc.) or environment-directed (active influence, evasion/avoidance, passivity, or using social support).

Subjects

The sample consisted of N=60 undergraduate students from the universities of Berne and Fribourg/Switzerland. They were recruited by other students, and received sF 50.- for participation. There was an equal number of male and female participants. The mean age was 26 years (std=4.4).

Procedure

The subject starts the computer program as soon as possible after or during a stressful episode. The program presents a sequence of questions asking for different rating answers. For questions requiring a scaled answer, the numerical and verbal scale level are presented simultaneously. The self-observational system of stressing encounters in every day life presupposes instructed and trained self-observers, who are made familiar with the method beforehand in a training session. The subjects recorded about 40 stressing events during 4 to 5 weeks. The recording of one episode took 5 to 8 minutes.

Structuring self-observational data for prediction analysis: Each of the subjects recorded an individual sample of stressful episodes during four to five weeks. The minimum number of episodes was 30, the maximum number 80. The mean number of observations (occasions = episodes) was 41.8. The event sequence of each subject was split according to the first and the second half of the sequence, so that we obtained 2 subsamples for each time period. The mean behavior ratings stemming from these time period subsamples were used as global behavior indicators. Then the

episodes of each half were grouped by a theory-based three-dimensional classification criterion into two classes of situations (table 1).

Table 1.

Theory oriented classification of stressful situations

perceived situation characteristics	classification criterion situations			
	class-1	class-2		
controllability	low-middle	gross & net	high	gross & net
changeability	low-middle	control	high	control
		not high		high
negative valence	high		low-middle	

This procedure permitted us to obtain for each person two subsamples split by time (sequence) which contained two situational classes each, according to a 2x2 factors repeated measurement design (2 situations x 2 times). A minimum criterion was set on 3 episodes per situational class and time period (of each subject). The aggregated measures are therefore based on 3 occasions at least. The procedure excluded some subjects and finally led to a sample of N=50 subjects.

Reliability and validity of the method.

For the estimation of the reliability a split-half method was used (Pawlik & Buse, 1982). The episodes of the individual record were odd-even divided, and the means of the selfobservational variables were correlated and corrected by the Spearman-Brown formula. Mean split-half-reliability over all variables was $r_{tt} = .85$, which was quite satisfying for free event sampling of episodes for self-observation.

How much do response sets distort the reporting of the perception of situations and coping behavior? For social desirability (measured by the SDS of Crowne & Marlowe, 1960) the median of correlations with all of the self-observational variables was $r = .09$ (absolute, positive or negative, amount), only aggressive feelings being significantly correlated ($r = -.30$). Due to the two-dimensional, four-fold concept of repression-sensitization as proposed by Krohne (1986) and others there were differences only in feelings of depression and abandonment ($F = 3.62$ and 2.80 respectively; $p < .05$; 'sensitizer' and 'high anxious' people reporting more of them).

For the analysis of the external validity of the method, we developed an S-R process questionnaire (UBV, Reicherts & Perrez, 1986), containing 18 standardized stressful episodes, which asks for the same responses as the self-observational system does (i.e. scalings of situation appraisals, emotional, and coping behaviors etc.). Global tendencies were well predicted from questionnaire to self report for emotional reaction variables (mean $r = .64$) and self-directed coping efforts (mean $r = .58$). Situation appraisals (mean $r = .37$) and environment-directed coping efforts (mean $r = .24$) were less correlated with the corresponding response type in the process questionnaire.

RESULTS

As outlined above, we should distinguish different types of psychological prediction of behavior:

(1a) The global, situation-unspecific prediction of behavior based on generalized dispositions ('big' traits) of the subjects,

(1b) the situation-specific prediction on the basis of more or less situational specific dispositions ('little' traits),

(2) the situation-specific prediction on the basis of a psychological theory (by explanative interpretation; e.g. Bunge, 1967), which connects the behavior to be predicted with certain characteristics of the perceived situation '*within*' the *subject* which is acting.

The global, situation-*uns*pecific behavior strength as observed and described by the subject can be predicted as follows: Behavior tendency of each stress and coping variable is aggregated for the first and the second half of the subjects' protocol. Behavior strength in the later period then is predicted by a 'law-like' hypothesis (H: there is stability of behavior B_i over certain time) and a pseudosingular condition (P has the tendency to behave B_i in period T_i). Conclusion: P has the tendency to behave B_i in the following period T_{i+1} . For predictions like this usually the correlation/regression model is used. The mean behavior strength stemming from several occasions (relating the subjects' earlier position within the distribution of the values in a sample of other subjects with its later position) serves as a predictor for a criterion given by another, later mean behavior value.

In our study these global temporal correlations of stress and coping variables related to general dispositions or traits are shown in Table 2 (1st column).

The *environment-related* coping behaviors were correlated by a mean of $r = .61$ (all these correlations were highly significant). This correlation mean corresponds to a determination of 37% of the later value variance by the earlier values. Evasion/avoidance as coping behavior type reached a higher correlation ($r = .74$) than passivity ($r = .52$); between them lay using support ($r = .60$) and active influence on stressor ($r = .57$). The *self-directed*

Table 2.

Correlations between period-1 and period-2 over all situations, and over situations of class-1 and class-2

	situations		
	all	class-2	class-1
mean number of episodes n	41.8	25.1	16.7
environment-directed coping behavior:	.61	.62	.46
evasion/withdrawal	.74	.76	.46
passivity/hesitation	.52	.54	.43
active influence	.57	.55	.48
using social support	.60	.58	.46
self-directed coping behavior:	.63	.68	.59
palliation	.57	.70	.72
reevaluation	.68	.61	.65
blaming himself	.64	.71	.61
blaming others	.62	.70	.31
emotional reactions:	.70	.71	.31
fearful	.71	.79	-.07
depressed	.70	.77	.26
aggressive	.64	.75	.07
inhibited	.70	.58	.61
indolent	.70	.56	.46
abandoned	.77	.77	.44
total	.66	.68	.44

note: coefficients corrected according to Spearman-Brown formula;
all correlation means based on z-transformed coefficients

coping behaviors in period-1 and period-2 were similarly related, their mean being $r=.63$. Behavior strength using the term blindly in period-1 predicted about 40% of the variance in period-2. Reevaluation as self-directed coping behavior was more stable ($r=.68$) than palliation ($r=.57$) and blaming self ($r=.64$) or others ($r=.62$). On the other hand the *emotional reaction or feeling* variables were more stable from period-1 to period-2. The strongest correlation reached $r=.77$ for feeling 'abandoned' whereas feeling 'aggressive' seems less stable ($r=.64$). All the other correlations were about $r=.70$. For emotional reactions the mean was $r=.71$, which indicates a somewhat higher stability than the coping behavior variables.

Michael (1966) proposed a concept to evaluate the predictive validity of product-moment correlation coefficients. Michael's formula allows us to estimate the probability of 'hits' in predicting the subject's later position relative to the sample median by means of his earlier position over or under the median. According to this, a mean correlation of $r=.61$ of the environmentdirected coping variables allows us to predict the right position over/under the sample median for about 71% of the subjects. For the global time-1-time-2 correlations of the emotional variables (mean $r=.71$) the predicted proportion of people over resp. under the sample median is about 76%. Both values, 72% and 76%, are substantially better than prediction by chance, which is correct for 50% of the cases. Once more we should emphasize that this kind of prediction deals with the position of the subject with respect to the subjects' behavior relative to a group or a sample, no matter if it be high or low.

Prediction by a situation-behavior-theory of stress and coping is based on the assumption that the subject takes into account some situational characteristics (like controllability, or valence) to select and govern his behavior. This, in turn, serves to realize the subject's goals. Prediction by the situation-behavior-theory of stress and coping is based on the earlier mentioned lawful assumption that the subject's perception of controllability, changeability and valence of the stressful situation permits the prediction of certain types of coping behavior.

According to this theory we expect a stronger evasion/avoidance tendency in situation-1 (than in situation-2), more hesitation/resignation and use of social support, but less active influence on the situation. Second, we expect more palliation of negative affect in low controllable and highly aversive situations like type-1, more blaming activity - blaming oneself as well as others and less reevaluation activity (because the strong negative valence makes it more difficult to change intentions and/or standards immediately). Third, we would expect more fearful, depressed, and aggressive emotional behavior as well as strengthened feelings of

inhibition, indolence and abandonment feelings in situations of low control and high negative valence.

The measure used here is a *prediction ratio* (*pr*): the number of subjects which are correctly predicted divided by the total number of predictions made. The prediction is based on the ordinal comparison of the subjects' summed behavior ratings in situational class-1 vs. class-2. The results are shown in Table 3 (1st column).

The predictions for *environment-directed coping* were true in 65% of the cases (median of prediction ratio *pr*). Best predicted were active influence (*pr*=.68) and the use of social support (*pr*=.66). Evasion and passivity were correctly predicted for 64% and 60% of the subjects, respectively. *Self-directed coping behavior* was correctly predicted in 67% of the cases (median *pr*). Predicting selfblame (*pr*=.62) seemed somewhat more difficult than predicting reevaluation and palliation (*pr*=.68), or blaming others (*pr*=.66). A better prediction ratio seems possible for the relative strength of *stress emotions* in different situations: A total of 76% of the cases were predicted correctly by the situation-behavior theory, with a maximum *pr*=.86 for depressed feelings, and the lowest prediction ratio for indolent affect (*pr*=.68).

The situation-behavior theory predicts relative behavior strength comparing two kinds of situations correctly with a total mean *pr* of 68%; in other words, in 68% of the cases our predictions for each individual of our sample were correct using our theory-based assumptions. A prediction ratio of 68% corresponds to an amelioration of 36% $(.68-.50)/(.50=.36)$ in comparison with prediction by chance. Except for passivity, the amelioration for all variables was significant (binomial test; H_0 : equal probability; one-tailed $p < .05$).

Another type of prediction, the *prediction by theory and stability*, is given by predicting the behavior which fits the situation-behavior-theory in time-2 of the stress observation record by the corresponding theory-confirming behavior in time-1.

The results (Table 3, 2nd column) show for the *environment-directed coping behavior* that 77% of the subjects who behaved in the theory-confirming way in time-1 also behaved in that way during time-2. For example: 77% of the subjects who reported the predicted difference by evading/avoiding from situation-1 more than from situation 2 already during time-1 also reported this difference during time-2. This indicates a relative high stability over time of these environmental-directed coping efforts if they conform to the theory. For the self-directed and intrapsychic coping efforts the mean proportion of correctly predicted cases was about 72%. Here stability, as it was defined, seemed a little lower, but

nevertheless it was substantial. Reevaluation of the stressor's relevance and self-blaming tendency as anticipated by the theory seemed to be more stable ($pr=.74$ and $pr=.78$ respectively) than palliating stress emotions or blaming others ($pr=.71$ for both).

Table 3.

Prediction ratio by different lawful predictions of relative behavior strength in situation class-1 vs class-2

	prediction by situation-behavior theory at time-2	prediction of theory confirming behavior from time-1 to time-2
environment-directed coping behavior (median)	.65	.77
evasion/withdrawal	.64	.77
passivity/hesitation	.60	.73
active influence	.68	.80
using social support	.66	.77
self-directed coping behavior (median)	.67	.72
palliation	.66	.71
reevaluation	.68	.74
blaming himself	.62	.78
blaming others	.68	.71
emotional reactions (median)	.76	.81
fearful	.74	.86
depressed	.86	.87
aggressive	.70	.76
inhibited	.78	.83
indolent	.68	.76
abandoned	.78	.79
total (median)	.68	.78

Predicting the *emotional reactions* in time-2 from time-1 seems quite effective, because the mean prediction ratio was about $pr=.81$; i.e. for 81% of the cases prediction of situation-relative emotional strength in time-2 was correct if deduced from emotional behavior in time-1. The best prediction ratio of $pr=.87$ was reached for feeling depressed (in stressful

situation of class-1 vs. class-2), whereas the lowest ratio of correct predictions was achieved for aggressive and indolent feelings ($pr = .76$).

For the whole set of self-observation variables, for the different coping efforts as well as for the emotional reactions, a total mean prediction ratio over time of 78% was obtained. This seems a satisfying result with regard to this kind of theory-guided prediction, which specifies relations of behavior strength depending on the type of stressful situation as encountered by the subject. The results showed that the *stability of the theoryconfirming behavior* was substantial. This is emphasized by the fact that stability of the behavior strength, which does not fit the situation-behavior theory, is very much lower: only about 48% of the cases in time-2 behaved in the same way during time-1.

Additionally, the total of theory confirming environment-directed coping behavior (period-1 and period-2 taken together) was substantially correlated with problemsolving behaviour during the stressful episode ($r = .47$; $p < .001$). This may serve as a kind of external validation concerning the 'effectiveness' of behavior, which may be more appropriate when this type of theory used for prediction.

DISCUSSION

Our aim was to compare different types of prediction on the logical and on the empirical level: predictability (1a) by general dispositions, (1b) by some more situation-specific but theory-free assumptions. Both may serve as 'rational predictions' by symptoms or indicators, and predictability by (2a) theoretical assumptions on situation-behavior-laws and (2b) supposing intraindividual stability of the laws.

The results showed that the latter approach to behavior prediction is rather encouraging. The best prediction was obtained for stress emotions. This type of behavior may be more predictable because it is more strongly related to the autonomous nervous system. However, it is probable that predictability in other kinds of behavior (especially of coping efforts) is partially mediated by the central nervous system. We conclude that it should be possible to optimize predictability by including the goals of the subject's behavior in the theoretical structure and empirical analysis.

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REFERENCES

- Bunge, M. (1967). Scientific research. The search for truth (Vol.II). Berlin: Springer.
- Crowne, D.P. & Marlowe, D. (1960). A new scale of social desirability independent of psychopathology. *Journal of Consulting Psychology*, 24, 349-354.
- Hempel, C.G. (1965). Aspects of scientific explanation and other essays in the philosophy of science. New York: The Free Press.
- Krohne, H.W. (1986). Coping with stress: Dispositions, strategies, and the problem of measurement. In M.H. Appley & R. Trumbull (Eds.), *Dynamics of stress* (p. 209-234). New York: Plenum.
- Magnusson, D. & Endler, N.S. (1977). *Personality at the crossroads: Current issues in interactional psychology*. Hillsdale, N.J.: Erlbaum.
- Michael, W.B. (1966). An interpretation of the coefficients of predictive validity and of determination in terms of the proportions of correct inclusions or exclusions in cells of a fourfold table. *Educational and Psychological Measurement*, 26, 419-426.
- Pawlik, K. & Buse, L. (1982). Rechnergestützte Verhaltensregistrierung im Feld: Beschreibung und erste psychometrische Überprüfung einer neuen Erhebungsmethode. *Zeitschrift für Differentielle und Diagnostische Psychologie*, 3, 101-118.
- Perrez, M. & Reicherts, M. (1986). Appraisal, coping, and attribution processes by depressed persons: An S-R-S-R approach. *The German Journal of Psychology*, 10, 315-326.
- Perrez, M. & Reicherts, M. (1987). Coping behavior in the natural setting: A method of computer-aided self-observation. In J.P. Dauwalder, M. Perrez & V. Hobi (Eds.), *Controversial issues in behavior modification* (p. 127-137). Lisse: Swets & Zeitlinger.
- Reicherts, M. & Perrez, M. (1986). *UBV Fragebogen zum Umgang mit belastenden Situationen im Verlauf*. Freiburg/Schweiz: Universität, Psychologisches Institut.
- Stegmüller, W. (1983). *Probleme und Resultate der Wissenschaftstheorie und Analytischen Philosophie*. Berlin: Springer.