Simulating strategies of interactive behaviour

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SIMULATING STRATEGIES OF INTERACTIVE BEHAVIOUR

CWK GLEERUP

BERNHARD BIERSCHENK

Simulating Strategies of Interactive Behaviour

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Simulating Strategies of Interactive Behaviour

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Contents

1. A short presentation

Effective communication is of crucial importance for the development of effective social organizations. Deficient communication combined with rapid technological and social changes appears to lead to both ecological and psychological imbalance. An increasing number of environmental groups are working for ecological improvements, but young people seem to finding it increasingly difficult to master the task of developing an integrated personality. This shows itself in stress and an inability to develop flexible behavioural strategies in interaction with other people.

For the purpose of testing new models and constructing new instruments for analysis and training of the individual's way of observing, evaluating and integrating information about himself and his surroundings in existing cognitive structures, we have developed an interactive behaviour simulator, based on a psycho-ecological model. This work is presented here.

Chapter 2 gives the psycho-ecological starting points for an analysis of the relation between cognition and behaviour. The basic unit in the psycho-ecological analysis is an event. It is assumed that perceptual experiences are directly related to events and that a person must first become aware of (observe) and understand (analyze and synthesize) events before what he has experienced can be integrated into an existent cognitive pattern.

Chapter 3 presents the principles for an interactive behaviour simulation and what it is that is interactive in this context. An explanation is also given of what is meant by "communicative skills" and when there is a lack of such skills. The chapter concludes with a summary of the aims of this research and development work.

In Chapter 4 three basic behavioural science paradigms are presented. It is assumed here that a person's behaviour is a function of his cognitive models, the purpose of which is to provide him with a system of rules for using or interpreting ecological information, i.e. the information mediated by different events. The attributive structure of the respective paradigms has been operationalized, in order to make it possible to study how far the basic paradigms function as a base for a person's interpretation of behaviour. A panel study is described, the purpose of which was to study the objectivity and reliability of the characteristics that are typical for the respective paradigms. Finally it is established with regard to the analyses described that it has been possible to reproduce the paradigms and that the reliability fulfils the demands that must be made on good objective measuring instruments.

Chapter 5 presents the design on which the simulation instrument is based. A brief concrete description is given of the way in which the interactive simulator functions. Several factors that are of importance for the construction work are also given, together with the way in which different events have been realized in a visual form by means of CCTV/VR techniques. Finally the task of the simulation is discussed and the importance of the time dimension for structurization of the simulation process is pointed out.

In Chapter 6 a few results are presented from the testing of the preliminary versions of the simulator. But the main emphasis in this chapter is placed on a study of the extent to which we have succeeded in building into the simulator the variables that are to mediate information referring to our three basic behavioural science paradigms. It is namely from these causal variables that are not directly accessible that we want to draw conclusions about which models steer the development of a behavioural strategy. Panel studies have been carried out, in order to study how far the affordance structure of the events really transmits in an objective and reliable way the ecological information with which we are concerned. Based on the results given, we can establish that our a priori hypothesis has been confirmed and that the simulator can be regarded as an objective and reliable instrument.

Chapter 7 describes some explorations into the evaluation of an adaptive behaviour simulation. In this evaluation the most important variable in the simulation process, i.e. the time dimension, has been taken into consideration. In this chapter it emerges that it is the association paradigm that appears mainly to steer the development of the course of events during the simulation process.

In Chapter 8 some suggestions are made for continued research and development work. The most important task now is the construction of an instrument for steering and controlling the event that will take place as the most probable consequence of a proposed action. When this kind of instrument exist, it should be possible to carry out a validation experiment.

The research and development that has been presented briefly here has received financial aid from the Swedish Council for Social Science Research and the Swedish Board of Education and the project (the SIR project) has been carried out at the Department of Educational and Psychological Research,

University of Lund-Malmö. Many people have participated in the work of the project. I would above all like to thank the project's research assistant, Gunlög Frost, for her interest and active contribution and for her help during the collection of data.

The project was greatly helped by a group of twenty-one research students, assistants and lecturers at the departments of educational research in Lund and Malmö, who were prepared to act as assessors in as assessment panel. It is a particular pleasure for me to thank them all for having worked so much and so successfully with no financial compensation.

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Malmö, 1978

B. B.

2. Psycho-ecological starting points

This presentation will be based on psycho-ecological assumptions and experimental results as presented in e.g. MacLeod & Pick (1974). It is an attempt to express a new and important change of direction in research into the psychology of perception and behavioural science. This change has not yet resulted in a new research tradition, which means among other things that no strict scientific methods have yet been formed that are on all points compatible with a psycho-ecological perspective. Hopefully, however, this study will at least contribute to a more precise definition and deeper understanding of the way in which a person develops behavioural strategies in interaction with his environment.

Ecological methods are used to study the mutual relations that exist between an organism and its environment. The study of the human being and his surroundings is here restricted to psychological phenomena in educational environments. We shall make a closer study of the way in which the immediate environment influences the student teacher's actions in a teaching situation and the way in which this in its turn influences the environment and so on. This means that the student teacher selects and generates events that are typical for him. But at the same time they are also the startingpoint for the student teachers specific way of re-acting. (For a detailed discussion of different meanings of the concept "interaction", see Olweus, 1976.)

In a given teaching situation, for example, the teacher's perception and evaluation of events determines whether or not he will manage to predict "correctly" either the pupil's behaviour or the consequences of the choice of an alternative course of action. The self-perception of individual people is assumed to be founded on a number of different events or experiences based on adaptive functions. Gradually the experiences become abstracted, structured and diffierentiated and as a consequence of the human ability in symbolic activities, they become generalized and incorporated into the individual's cognitive structure, i.e. they form a person's implicit cognitive models concerning himself and the world around him. In an ecologically-based analysis of how a person's implicit cognitive models steer his development of behavioural strategies it becomes important to study events, experiences and the adaptive relations that exist between them.

In an ecological analysis of teaching processes or in process research in general, the basic unit or analysis unit is an event. An event can be defined as something e.g. an outcome or a result of an action that takes place at a particular point in time and at a particular place. The fundamental idea in this experiment is that an event that is important for the individual will lead to demonstrable structural changes in his patterns of cognition or behaviour. On the basis of Gibson's (1966) assertion that the perception of an object's gestalt is based on perception not of form, but of shapeless invariants over a period of time, Shaw, McIntyre & Mace (1974, pp. 276-310) develop the theory of symmetry that is an explicit interpretation of Gibson's assertion. They base their theory on Cassirer's (1944, pp. 1-35) article, "The concept of group and the theory of perception". The concepts of modern geometry, such as "invariance" and "transformation" are basic to a theory of symmetry. The authors present experimental results that support the hypothesis that invariant ecological information specifies both the gestalt of the object and kinetic orientation. The results are interpreted from a geometric perspective, namely that characteristic properties of an aggregate (unified elements), are determined by the group and not by the elements from which an aggregate has been constructed (see Cassirer, 1944, p. 24), i.e. a given transformation function defines an event.

The writers present experimental results supporting the hypothesis that invariant ecological information specifies both the object's gestalt and kinetic orientation. But this depends on a harmonious conjunction of structural symmetry and the transformation that defines an event, i.e. something that takes place at a given place and a given time. According to Shaw et al, the individual perceives primarily the event's "affordance structure" and not its inherent physical structure. This argument is of importance not only for a study of events but also for a study of the individual's cognition. It is above all the following two statements in Shaw's et al (1974, p. 294) argument that are important for our investigation.

1. Perceptual experiences are directly related to events via symmetry relations.
2. The affordance structure of the event can be predicted on the basis of the theory of symmetry.

According to Shaw et al, symmetry operations are of a general nature and can be applied to non-rigid, complex structures, even if the logic behind them is still little understood. However, if we accept the theory of symmetry presented by Shaw et al as a working hypothesis, the aim of the study can be reformulated to the following hypothesis: The student teacher's development of interactive behaviour strategies is characterized in every phase by a thorough reconstruction of strategies established earlier. By thorough we mean here a reconstruction in accordance with rules stating the way in which separate events are to be related to each other. Known transformation functions can concern e.g. "similarity" or "affinity".

According to the symmetry law, a sufficient number of structural proporties remain invariant during the transformation. Thus it should be possible despite the transformation to prove an evolutionary connection between new and previously established behaviour strategies.

Another working hypothesis formulated by Shaw et al (1974, p. 282) that is important to our study can be expressed by the following statement: Events are similar insofar as they have a common affordance structure. A scientific understanding of the affordance structure of an event could provide a basis for an objective analysis of the individual's experience structure. And since we shall be discussing events as transformations of events perceived earlier, invariance will be looked upon as phenomenological identity. This relation can also be expressed in terms of perception psychology as constancy (see Cassirer, 1944, p. 16).

3. A model for simulation of interactive behaviour strategies

The primary aim of all education must be that a person should learn to predict the consequences of the action he has chosen to take. Moreover, the ability to form one's behaviour according to "pre-arranged hypotheses" and to develop behaviour strategies leading to successful interactions with others is of particular importance in the social professions, such as teaching.

A simulation of interactive behaviour strategies means that attention is drawn to (1) the mutual relations that can be assumed to exist between a person and his environment and (2) the dynamic aspects of the relations. At the same time a "clean slate" is not a prerequisite, nor is it assumed that the individual starts from scratch in each new learning situation. On the contrary the simulation is based on the assumption that the individual's cognitive system, based on knowledge that has been abstracted from experience, determines the learning.

If an interaction between e.g. a teacher and a pupil is to come about, the cognitive systems of both must function at least moderately successfully. The model that has steered the development of our system for simulation of interpersonal relations (SIR) is shown in Figure 1.

Briefly we can say that SIR starts with a problem situation that has been recorded on videotape. Depending on the student teacher's choice of and suggested action, the "consequence" is shown in the form of a pupil behaviour that has been recorded on videotape. Thus the model illustrates a case in which two individuals interact. The prime number denotes that a dynamic relation exists between the two, i.e. individual 1 (I_1) changes as he learns something about individual 2 (I_2), and I_2 changes as he learns something about I_1.

But in concrete terms the aim of an interactive behaviour simulation is to increase the ability of the teacher to play an active, creative role as a member of teaching groups. Based on the principle model in Figure 1, we have attempted to develop a method and technique that will help individual student teachers to perceive and evaluate their own behaviour and to develop

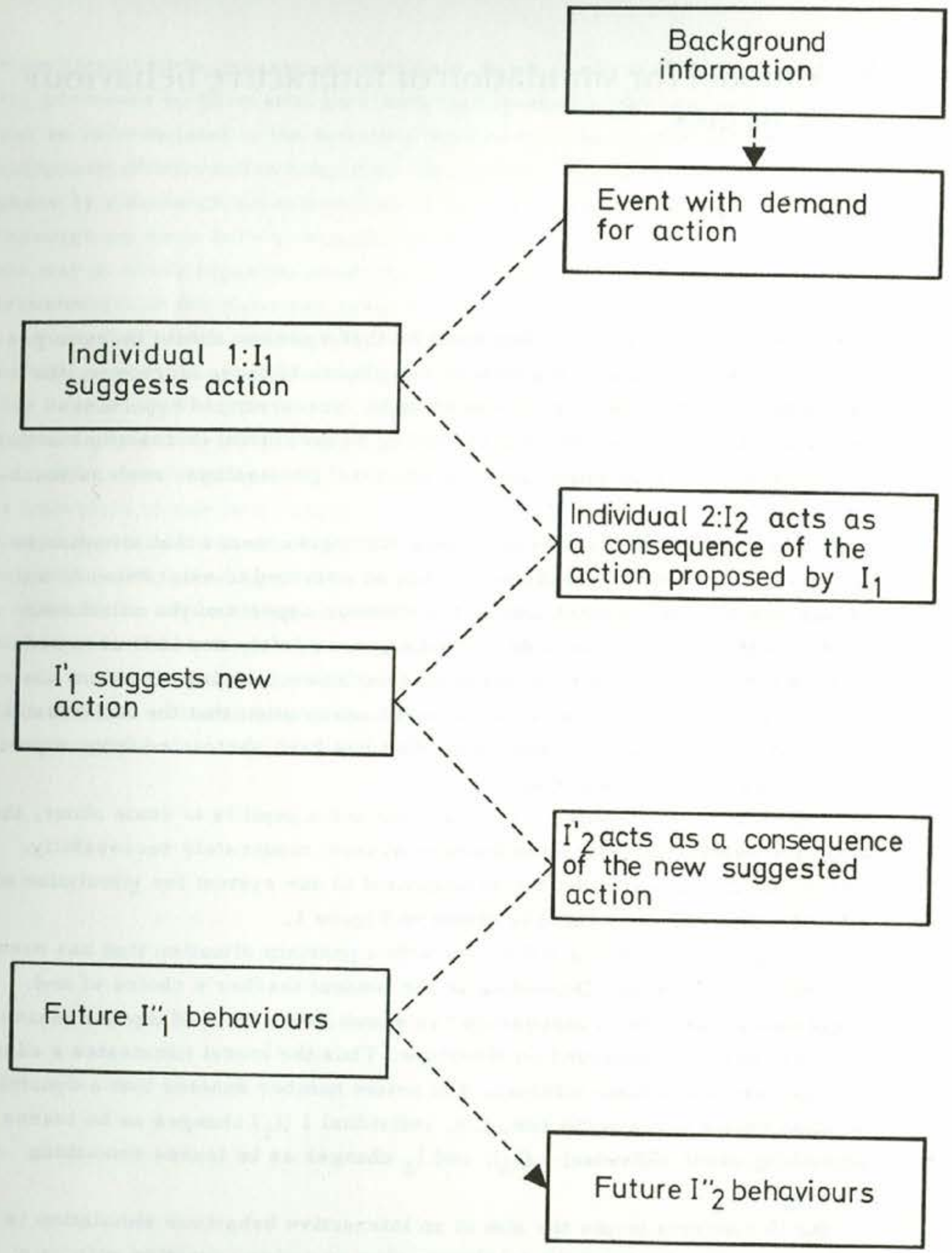


Figure1. Outline of principles for an interactive behaviour simulator

their communicative skills in their relations with pupils.

We work on the assumption that from birth to adulthood a person accumulates behaviour strategies so as to be able to cope with various situations. This means that attention is concentrated on the problem of developing instruments which make it possible to study which behavioural strategies individual persons make use of and which strategies are available in various situations and on various occasions.

Communicative skill is defined here as the ability to shape one's behaviour in accordance with "pre-arranged hypotheses" and to develop behaviour strategies that lead to successful interaction with others. It assumes that an individual can choose between alternative behaviours and that the individual can develop criteria-congruent patterns of behaviour, i.e. patterns of behaviour that agree with implicit or explicit plans for organization, coordination and synthesis.

By definition a lack of communicative skill exists when the individual's behaviour strategies consist of separate behaviours that succeed each other in a stereotyped or automatic fashion. Behaviour stereotypes (automated behaviours or routines) can therefore be defined as a fixed succession of behaviours that are not influenced by new information. Consequently fixed behaviour patterns are not influenced by ecological information, either, i.e. the information transmitted by an event.

An interactive behaviour simulator would enable the individual student teacher to study the causal structures that exist in the dependence between different events and in that way analyze why the effects of his own behaviour (a proposed action) are not what he himself or others expected.

Hartmann's (1958) concepts "automating" and "deautomating" aptly describe the individual's inability and ability respectively to develop adaptive behaviour functions.

Automating implies a relative autonomy from the influence of both the individual's motivation and of the environment. According to Gill & Brenman (1959, pp. 155-203) automating means that a structure has been built up, the fundamental constituents of which can no longer be manipulated by the individual. This formalization and simplification is a behavioural process and not a condition. By means of a continual elimination of details the process becomes structured. The ability to automate various behaviours is both necessary and economical with regard to the individual's private saving of energy. But automated behaviours can also have a detrimental effect on the way in which the individual functions, namely in cases where the individual has lost his ability to adapt to the changed conditions of the environment. Thus being able to develop well-functioning strategies in interaction with others requires that individual persons can continually deautomate behavioural functions. A person acting flexibly can be recognized by his ability to de-automate particular functions, when there are circumstances in the environment requiring more specific and flexible adjustment of a behaviour strategy than automated functions can permit. Being able to de-automate a behavioural function presupposes that the individual's attention is directed at the behavioural function concerned.

Our aims in developing a model for an interactive behaviour simulation can be summarized in the following points:

1. to construct an instrument that will make it easier for a person to develop his communicative skills, i.e. his sensitivity in understanding a course of events and ability to develop a flexible behaviour strategy in interaction with other people,
2. to develop an interactive behaviour simulator in agreement with the following three basic models from behavioural science, the (1) association, (2) structure and (3) process paradigms. (For discussion, see Chap. 4.) In this way we hope to be able to study the principles of behavioural science on which action strategies are built up,
3. to create opportunities for individual persons to (1) increase their self-understanding, (2) practise the use of systematic self-observations, (3) teach themselves intraindividual and interindividual process analysis, (4) get further training in self-diagnosis and self-change and (5) teach themselves to synthesize and integrate their own experiences in the existing cognitive structure.

A development of methods for constructing interactive behaviour simulators within various social sectors such as teacher training, nursing and pre-schooling could create the prerequisites for the design of laboratory training, i.e. training based on the student's own teaching experiences. The nature of the experiences or the essential basic parts of an interactive behaviour strategy would then be defined by the actions (operations) that generate the strategy in question. But since the actions are in their turn dependent on given and controllable conditions, the experiences from a laborative training can be subjected more directly to diagnosis and synthesis than experiences in general can.

4. Implicit models

An interactive behaviour simulation based on psycho-ecological principles requires an operationalization of the "affordance structure" of the events. As was shown in Chapter 1, an event is namely the smallest significant unit in a psycho-ecological analysis of interactive behaviour strategies. In order to be able to represent the affordance structure in an event, a few variables have been built into SIR that are indirectly to cause effects and in that way influence the individual's cognition and suggestions for action. This means that we differentiate between proximal (closest, tangible) and distal (furthest, non-tangible) variables.

One of the main aims of the work on SIR is to study the relations that are assumed to exist between proximal and distal variables. The creation of representative proximal-distal relations leads immediately to the question of whether the relations are to be represented in an "abstracted" or "concrete" form. (For discussion, see Hammond, 1972, pp. 285-286.) By an abstracted form is here meant properties (e.g. statistical or paradigmatic) that have been abstracted from a concrete situation and that can be representative of a particular given environment. By a concrete form is meant a direct content in an object or a task. Considerable technical problems are involved in finding representative cognitive tasks and subjecting them to laboratory conditions. On the other hand, it is clearly possible to achieve representative tasks in an abstracted form, which can also be subjected to experimental conditions. Therefore, we have chosen the second alternative. This means that we have from concrete tasks abstracted different relations (see Bierschenk, 1975) and decided to incorporate these into SIR. In this way we hope to be able to achieve a systematic behavioural science identification, analysis and testing of how far interactive behaviour strategies are developed on the basis of existing basic principles of behavioural science. In the opinion of the writer, only three fundamental paradigms of behavioural science exist, namely the association, structure and process paradigms. The first assumes that associations are the building blocks in a theory of behaviour. The second assumes that the building blocks are an a priori determined "structure" or gestalt, while the third assumes they are a process of assimilation and adaptation. These three form the behavioural science foundation of SIR.

In teacher training, the students are taught educational and psychological theory, partly for the purpose of providing them with a theoretical basis for the interpretation of behaviour. If this training is to have a meaningful purpose, we must assume that theories of behavioural science help a person to find out how his own and others' behaviour can best be predicted.

To a greater or lesser degree everybody possesses self-knowledge. But this knowledge is not directly accessible for testing and comparison. This means that we need to develop methods for a study of empirical phenomena that escape direct observations. Observations are namely the basic elements in an analysis and synthesis of empirical phenomena. One of the characteristics of observations in the sense intended here is that they have intersubjective agreement.

One method for determination of intersubjective aggreement is panel assessments. By means of an assessment panel we have tried to prove the objectivity of the property structure that according to our conceptual analysis (see Bierschenk, 1977b) should characterize the association, structure and process paradigms respectively.

4.1 Panel assessment

Fundamental to panel assessments is the assumption that independent assessors can reliably identify the property structure that is characteristic of the object being assessed. If one then uses twelve or more assessors, the reliability can be as high as it is for good objective tests (see e.g. Guilford, 1954, pp. 251-256; Cattell, 1973, p. 250).

In order that we might be able to study whether and to what extent the conceptually defined property structures of the association, structure and process paradigms can be demonstrated, an assessment panel was formed. The assessors that were to sit on the panel were selected from among the post-graduates doing doctoral work in Malmö and Lund during the spring term of 1977. In addition some research assistants and lecturers with appointments at the department of educational and psychological research in Malmö and the department of education in Lund respectively also participated. In all twenty-one persons agreed to sit on the assessment panel. The following text had been prepared for training the assessors.

4.1.1 Theoretical anchorage

The basic idea behind the teaching of educational and psychological theories should be that an interpretation of human actions cannot take place independently of a model or theory. Models and theories could be of help to the individual in finding out how the environment influences a person, how he reproduces the experiences and how earlier experiences influence new ones. In this connection we shall assume that many different theories of behavioural science exist but that they are all based on one of the following basic models (paradigms): (1) the association paradigm, (2) the structure paradigm and (3) the process paradigm. It is mainly the S-R theories, based on the reflex arc paradigm, that have been fundamental to interpretation of the behaviour of animals and people. Behaviour is regarded primarily as a "response" to "stimuli" that exist outside the individual. Thus upbringing and education are in principle responses or reactions to conditions in the individual's environment. Children are brought up by manipulation of socially acceptable behaviours, where desired behaviour is rewarded and undesirable behaviour is prevented (blocked). During the years at school learning takes places in accordance with Skinner's "reinforcement" of correct responses in agreement with carefully worked out plans for the successive building up of increasingly complex behaviours, partly by means of teaching machines.

The antithesis is mainly formulated within the framework of the gestalt theories, based on the structure paradigm. Gestalt is a German word with no exact equivalent in English, and therefore this concept will be used as it stands, with no attempt made to translate it. The thesis of a predetermined structure, i.e. a predisposition of the genes is fundamental to the interpretation of behaviour. Intellectual behaviour is interpreted as a result of biological processes, and an experience of insight occurs through a new structuring of the individual's visual field. This means that nothing external (i.e. experiences in the present or in the past) can cause this formation. Learning is less important compared to processes of maturing. Experiences in the present are only important insofar as they release or necessitate this structurization (which is a consequence of a given degree of maturity in the nervous system or perception organs of the individual) but they are of no significance for the actual learning i.e. they have no explanatory value.

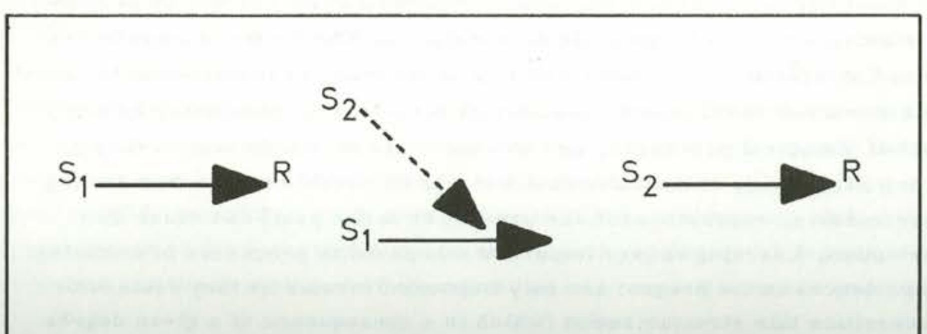
The synthesis is formulated primarily within the framework of the theory of general systems, based on information feedback and control. The basic factor in the interpretation of behaviour is an interactive relation between individual and environment, which means that a time dimension is incorporated and experiences given a central place in the model. According to the process model, awareness does not begin with awareness of objects or activities but with an undifferentiated state of mind.

4.1.2 The association paradigm

Reflex is originally a physiological concept that has been created in connection with the assumption that there is a reflex arc, namely
Stimulus → Receptors → Afferent nerves → Synapses →
Efferent nerves → Effectors → Response

This paradigm, which was abbreviated to S→R, became at the beginning of the twentieth century the building block for theory-formation in behavioural science. Above all Pavlov's experiments with conditioned reflexes form the basis of the development of the S-R theories. Pavlov experimentally demonstrated the following: When a dog hears a bell (S_1) together with the sight of food (S_2) for the first time, this produces gastric reactions (R) that are started by the food. When the dog later hears the bell, it reacts to S_1 as if S_2 existed. This process is symbolized in Box 1.

Box 1. Symbolization of the association paradigm



The process in Box 1 has been interpreted as being that the dog associates the bell with the food. Pavlov explained this process purely physiologically. He assumed that the dog's sense receptors are stimulated by signals from the food. The dog "perceives" the signals from the food and starts to produce saliva, which presupposes so-called nervous impulses. If the sense receptors are stimulated at the same time by signals from a bell, it is not only the cerebral centre responsible for hearing that is stimulated. Pavlov assumed that different cerebral centres are via the nerve paths in direct contact with each other. If different cerebral centres are now activated by signals coming simultaneously from both food and the bell, associations take place. The S-R theories formed during the 1930's are based mainly on the assumption that new reactions can be replaced by means of cues that have some connection with old behaviours. By carefully identifying these cues and introducing new behaviours at suitable points in a sequence of behaviours, new habits could be established. This requires programmes for stimulus control. It is of fundamental importance for classical experimental design and interpretations of S-R theories that desired behaviour is built up by a thorough control of stimuli and that a behaviour is retained by reinforcement of consequences or "experiences".

The importance of experiences has been treated within empiricism. Empiricism regards experiences as something that forms the individual without he himself needing to structure the experiences in question. Experiences impress themselves directly on the individual without the individual's activity being a necessary prerequisite. This means that the environment asserts its influence. Even conditioned reflexes, i.e. linkages forced on someone by the environment, associations and patterns of behaviour include the importance of experiences.

The building up or installation of behaviours and their extinction or deconditioning (contra-conditioning) are central areas of study in the research tradition of S-R theory. The answer to what is suitable for reinforcement is directly connected with the question of who or what controls the individual's behaviour. The S-R theories are based on the assumption that factors in the environment cause the forming of behavioural patterns (habit structures). Thus S-R theories are not formed to explain structural changes in characteristics or traits of the personality. Nor do they assume that what the individual has learnt during childhood is irrevocable or that these behaviours should determine the individual's behaviour as an adult or the individual's behaviour in a situation differing from the learning situation.

During the 1940's and '50's, however, new components were introduced into the S-R model. Two different behavioural levels are now differentiated, namely (1) automatic-reflexive behaviours and (2) behaviours mediated via internal representation and symbolization, i.e. higher mental processes. Moreover on the second level, two different types of behaviour are differentiated. One is called "instrumental behaviours", while the other was named "cue-producing responses". The first type comprises all intentional motor behaviours that an individual carries out for the purpose of creating a change in relation to his environment. The other type has been defined as complex problem-solving, language, thoughts and images that mediate socially complex behaviours. This expansion of the S-R model means both that the classic model has been given cognitive components and that the S-R theoreticians are allowed to laborate with concepts such as cognitive awareness. Thus Pavlov's dog would behave towards S_1 as it would behave towards S_2 because it implies S_2 in S_1.

This reinterpretation of the dog's behaviour means as follows: If event S_1 takes place, then S_2 follows (see Box 1). The if... then logic contains experiences, i.e. it is no longer enough to assume simple associations. Implications are namely a result of cognitive processes. While associations only require that the bell in the dog's memory produces or recalls the food, implications presuppose that the bell becomes a symbol for the food, i.e. the bell takes over the function of the food, namely to produce the secretion of saliva. This modification has also had the further result that the dog is allowed to know which stimuli are followed by food, i.e. the dog's behaviour can be controlled by means of so-called discriminating stimuli that have been associated to reinforced behaviours.

Reinforcement in its classic sense involves an administration of a physical act through an "agent" outside the individual. Reinforcement can be regarded as a reaction that has such properties that it is suited to a successive construction of increasingly complex behaviours ("shaping"). In this process different behavioural principles are applied and different ways of maintaining most of the learned behaviours ("operants"). An effective social reinforcement is therefore only meaningful insofar as it is given in such a way as the norms of the context prescribe.

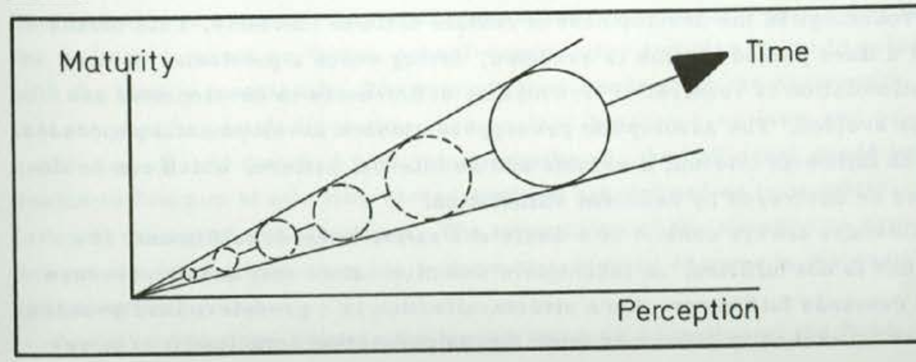
If we now transfer this description to a teacher-pupil situation, it could be described like this: The teacher wishes to <u>reinforce</u> the pupil's <u>positive</u> behaviours by a <u>reward</u>, such as by encouraging the pupil. Non-desired reactions are expected to be blocked. In order to get the pupil to react eventually in the desired way, the teacher makes use of systematic influence (successive approximations), i.e. adjustment to the class takes place by means

of small steps. The teacher waits for desired reactions from the pupil, which he then reinforces. In order to succeed in his attempts, he avoids asking delicate questions. Thus he does not want the pupil to have negative experiences of school. Moreover he tries to find out what the pupil likes and finds positive. This is exploited by the teacher and he reinforces it by letting the pupil do what he enjoys doing.

4.1.3 The structure paradigm

Gestalt is a concept that has been created in connection with the assumption that stimulation of the sense receptors leads not to associations but to structured ("gestaltete") wholes. The gestalt theoreticians assume that "physiological gestalts" are produced in the brain and that the explanation of a behaviour is to be found within the individual himself. If, for example, the individual's eye is stimulated, a mosaic of points of stimulation appear on the retina. From there the signals are sent to the cerebral centre that is responsible for visual perception. In the brain, however, they are not summarized as a simple function of the sum of the tracks or paths that have been shaped as a result of the pressure of the environment, but as a stimulation gestalt. This biological mechanism is assumed to lead to gestalts that are complete in their structures and perfect in their functions. Thus the gestalt theoreticians assume a predetermined structure, i.e. a predisposition in the set of genes. The individual's ability to perceive and degree of maturity decide the quality of the gestalts. The process is symbolized in Box 2.

<u>Box 2.</u> Symbolization of the structure paradigm



The process in Box 2 has been interpreted as showing that the individual's maturity and the functioning of the organs of perception are decisive for the gestalts' development. In order to explain the reorganization mechanism (which is symbolized by the ever-larger circles), the gestalt theoreticians speak of the pressure towards so-called "gute Gestalten". From the results that have emerged from a number of laboratory experiments with geometric figures, they consider that they can prove that gestalts replace each other in accordance with the law of pregnancy, i.e. the law of intellectual order. This process is completed when the good gestalt, i.e. the best intellectual order, gains the upper hand. Good gestalts are those that fulfil a number of criteria set up by gestalt theoreticians, such as simplicity, relation, completeness and self-containment.

The individual's cognition is looked upon as a continuous reorganization of the visual field, by the inadequate gestalts (the smaller circles in Box 2) being exchanged for more adequate ones. In this way the general cognitive development is a result of nothing more than the individual's maturity, which is directed towards the best gestalt.

Congenital factors are assumed to be decisive for the individual's development of a behaviour pattern. On the basis of the genetically conditioned cognitive structure, one also assumes that human behaviour is guided by a system of gestalts. These gestalts, which follow each other, always form a whole, i.e. they cannot be reduced to associations, combinations or empirical origin (experiences), since they both have their origin in the nervous system and, as far as their formation is concerned, are determined by maturity and perception. However, if the individual has not achieved the degree of maturity necessary to "see" things in a particular given situation, one can only wait for the point in time when he suddenly gains insight (Aha-experiences). Gestalt theoreticians assume that there are critical periods during which the individual is especially sensitive to the influence of his surroundings in the development of certain definite functions. This means that a fixed period of time is assumed, during which a particular amount of stimulation is required if irrevocable deficiencies in development are to be avoided. The assumption presupposes inborn developmental processes, which follow an internal timetable and an internal pattern, which can be delayed or destroyed by deficient stimulation.

Gestalts always consist of a whole and strive towards fulfilment. If a gestalt is not fulfilled, an incomplete situation exists that exerts pressure and demands fulfilment. Since structuralization is a predetermined process, which by necessity sooner or later forces perception upon itself, it is repeated every time a situation demands it, i.e. the structure reproduces itself. Gestalts tend to make themselves known, but it is always the most important gestalt that emerges first. But the structuralization can also be applied to new objects in cases where it is necessary. This means that the structuralization differs between gestalts. If, however, the relations that exist between separate gestalts are summarized in categories, a generalization process arises, which is the opposite of differentiation.

If we now transfer this description to a teacher-pupil situation, we could describe it in the following way: The teacher apprehends the teaching situation as a whole or a unit, within which one detail is picked out among many possible ones. This detail becomes particularly prominent, while the others recede into the background. The teacher's intention is to investigate the structure in the teaching situation, since by understanding it, he can change the structure in order to facilitate Aha-experiences in the pupil. In this he always addresses himself to an individual pupil, i.e. his actions are based essentially on dyadic situations. The teacher concentrates wholly on the pupil in question, in order to map his background and action pattern. He wants to form a complete impression while at the same time trying to get the pupil to gain "insight" about himself and the situation in which he finds himself. He hopes to be able to get the pupil to abstract and to integrate his abstractions, i.e. complete incomplete situations. The relation between foreground and background give the situation its content, namely. By what he says and does, the teacher wishes to gain information about the pupil and get the pupil to work through his unfinished gestalt. The teacher symbolizes the pupil's "incomplete ego". What is of interest is the immediate situation in which the pupil finds himself, <u>how</u> the pupil acts and feels at a particular moment (the present). The pupil's action is dependent on the uniform field that encompasses both himself and his surroundings. The teacher tries to get a complete impression, both in order to map how the details (gestalts) are related to each other in the "system" school or "home-school-community" and also to get to grips with the pupil's mental life. The teacher then starts from the assumption that the pupil's gestalt formations are unclear but they have form and organization. For if they had been totally shattered, the individual would be unable to function at all. Non-closed gestalts are defined as incomplete tasks or noncompleted situations. The importance of the situation is brought out and the teacher focusses his actions on achieving changes in the pupil's consciousness.

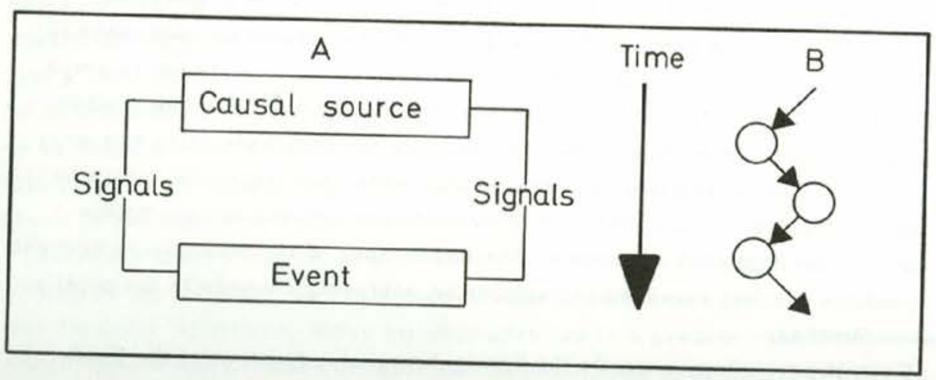
Gestalt psychology regards the human being as a function of the field (organism and environment) and actions as a reflection of the human being's relative position within this field. Starting from principles of gestalt psychology, it can be said that the teacher's aim is to get the pupil to function independently so that he is no longer exposed to forces (other people) that he cannot control.

4.1.4 The process paradigm

Process is a concept that has been created to state movements ("dynamics"). According to the process theoreticians, an event is the smallest significant unit. The physiological assumption is that there is a constant flow of signals from a source. But this is not enough for the individual to be able to see anything. What is needed to enable the individual to see is a physical event that breaks this constant flow of signals. The basic perception-ecological assumption is that most, if not all, of the properties of the perceived (observed) world are produced directly by stimulation of the individual's sense-organs. This has led to the supposition that there is a function circle, i.e. a circular causal chain which says that the signals return to their point of origin. The process is symbolized in Box 3, Figure A.

The process in Box 3, Figure A has been interpreted as showing that the individual's sense-organs are stimulated by objects that are distributed over a visual field. By means of the perception organs, continual representative random samples are taken, which fit into a given stimulation of millions of receptor cells. This is called "pattern recognition". Through

Box 3. Symbolization of the process paradigm



continual changes in the distribution of the cells, different patterns emerge. Changes can be achieved both through the objects themselves, i.e. they change colour and appearance by means of e.g. light contrasts, and also through the individual changing his relative position in relation to the object. The fact that the relations between individual and object can be changed is interpreted as meaning that the individual changes his standpoint. Thus what the individual "sees" is physical events from which information is abstracted. This information is called ecological information, in order to state the direct connection that exists between the individual and environment. With this assumption, perception-ecological research has overcome the "thing perspective", i.e. an all too concrete way of regarding stimuli. Thus only if there is a break in the continuous flow of signals (through an event taking place) does a process arise that leads to ecological information.

According to the process theoreticians it is events that lead to adaptive relations between the individual and his environment. This is symbolized in Box 3, Figure B. The circles symbolize two open, interacting systems (the human being and his environment). Starting from the way in which the individual reacts to stimulation, it can be said that the individual's adjustment to his environment demands that there must be similarities between the individual's state (biologically, psychologically) and the state of the environment. Therefore there is no longer a world of neutral, objective and mutually exclusive stimuli. They have been exchanged for dimensions.

According to the process theoreticians perception encompasses physical and motor activity. But motor adaptation to visual stimulation requires practice, it is not achieved automatically. The assumption that a simple perceptual world exists from the beginning has been tested experimentally. The results show, for example, that auditive-visual coordination is something that is not inborn, but is something that the individual must learn. Since an audio-visual coordination can be considered as a transformation of earlier observed events, e.g. auditive and visual stimulation, the result of an audio-visual perception process could be regarded as an abstraction of "common" ecological information, i.e. a generalization.

Since experiences and practice are included in the model, the cognitive structure is linked to the individual's own prerequisites. The individual's cognitive development consists of continuous restructuralizations. This means that it must be possible to maintain a sufficient number of structural properties in a given structure while others are transformed to a new structure. In this way continuity is maintained. This process can also be viewed as a reorganization of the individual's frame of reference, i.e. cognitive structures, which have been established in the past, are corrected.

A correction of cognitive structures presupposes that the individual can formulate hypotheses and can accept or reject them. This means that abstracted ecological information is checked against a background of established criteria, which are individual specific. This control of ecological information is required if the effects of individual specific experiences are to be used in a gradually evolving transformation of cognitive structures.

As a result of the individual's adjustment to different conditions, the content of the information changes, which leads to new processes of transformation. When the individual relates different events with each other, experiences arise. Perceptual experiences are assumed to be directly related to events. However, the effects of the experiences are not looked upon as learning in the classic sense. It is the effects of the exercises that determine the individual's cognitive structure and not the contrary.

If we now transpose this description to a teacher-pupil situation, the following can result: In his actions the teacher takes into consideration two main key concepts (1) message and (2) check of message. He regards the classroom as a system where information is mediated and checked. This implies an active utilization of the opportunities offered by a group of pupils regarding communication and control of information. His purpose with this system is to mediate information that is meaningful to the individual, i.e. information that the individual can check against his own hypotheses. The teacher's intention is to develop the pupil's sensitivity in perceiving a course of events. It can be difficult for the pupil on his own to develop flexible behaviour strategies in interaction with others in the class. The teacher tries with the help of the class to make the pupil act, in order to give the pupil a chance to observe others' reactions to his actions. Another goal is to let the pupil experience how his own thoughts affect his way of looking at himself and at the environment provided by the class.

If a communication process is to arise, it is necessary that the participants feel secure. By letting the pupils work together, the teacher tries to create this sense of security and thereby a prerequisite for the pupil's ability to analyse his own actions and in that way gain answers to his questions. When the teacher lets the pupils work on tasks that necessitate interaction, a feedback of information takes place. This feedback also applies to actions that the pupil is aware of (i.e. they are directly controlled by the pupil). The teacher himself tries to create unambiguous messages. He does

this by describing rather than evaluating. In addition he strives to give specific judgements rather than general ones. The teacher takes care that the pupil personally accepts the information mediated in the situation in question.

4.2 Operationalization of the paradigms

As their first assignment, each assessor was asked to state the content of the text (Chap. 4.1.1-4.1.4) in the form of key-words. This preparation took about two months. On the basis of the key-words, an assessment form was drawn up. The characteristics that the assessors were to assess on a nine-point scale with the end-points "does not emerge at all" (1) and "emerges clearly" (9) are those given in Box 4.

Box 4. Operationalization of the association, structure and process paradigm

No	Association paradigm
2	Reinforcement of positive behaviours
7	Search for reinforcement (interests)
8	Extinction (contra-conditioning)
9	Systematic influence (successive approximation)
10	Encouragement of desired behaviours
11	Repetition of successful behaviours (contiguity)
13	Utilization of existing habits (incitaments)
20	Distraction of attention from negative experiences (distraction)
	Structure paradigm
3	Creation of opportunities which facilitate structuralization and leads to clearness
5	Concentration on the whole
12	Confrontation with the aim to achieve changes in consciousness
15	Concentration on the present
18	Creation of Aha-experiences
	Process paradigm
1	Creation of possibilities for mutual control of information
4	Correction of earlier established cognitive structures and utilization of earlier experiences
6	Utilization of groups and the group's demand for adaptation
14	Activation of groups with the aim to make aware one's own behaviour in the interaction with others
16	Creation of situations which give greater possibilities to interaction (adaptation)
17	Structuring of the environment as an aid to create group membership that gives a feeling of security. (Structuring of environment)
19	Creation of group structures that make possible a mutual exchange of information

The twenty statements in Box 4 form the assessment instrument. The order of sequence for the separate statements has been arranged randomly for each individual assessor.

Each paradigm that has been operationalized in this way is naturally too limited by itself to form a foundation for an explanation of the whole connection between an individual's cognition and shaping of behaviour strategies. But to make it possible to study in which way the paradigm can be expected to influence the shaping of a behaviour strategy, "cues" have been built into each situation (scene) that has been video-recorded. These cues are intended to mediate information that is important for allocation of the scene to the association, structure or process paradigm. The way in which the individual paradigms can possibly simultaneously influence the student teachers' behaviour strategies depends naturally on the respective person's implicit cognitive models. If we are to be able to draw conclusions as to whether and to what extent the student teachers are sensitive to a certain type of information, we must a priori know about it. Thus we must be able to know which information de facto is available in a given situation so that we can study (1) the correlation between an information carrying variable (i) and the situation in question (r_e), (2) the correlation between an information-carrying variable (i) and the student teacher's assessment (r_s) and (3) the correlation between the student teacher's assessment and the situation (r_a). Here it is assumed that the student teachers have different degrees of sensitivity (i.e. allocate different probabilities) to the information-carrying variables. If they show a large covariation with the not directly accessible causal variables, we can establish that there are regular relations between the student teacher's implicit cognitive models and the models that are typical of SIR, i.e. similarities of structure exist.

For the assessment of the video-recorded scenes random orders have been generated and when they are assessed the scenes are shown in twenty-one random series, i.e. one for each separate assessor. The panel was given the following instructions:

"You are going to see a number of scenes that are recorded on video-cassettes. Usually the scenes show very short courses of events. You are to assess the scenes in the order in which they appear. The assessment should be done in this way:

1. When you see the scene on the TV screen, you are to observe it carefully. Write nothing!
2. Immediately after the first scene is over, you mark your answer on the scales given below.

3. Mark on each individual scale the extent to which you consider that the aspect in question steers the course of events."

To guarantee that each assessor carried out the assessments independently of the other assessors, a timetable was drawn up in which each one had his own time. The number of hours that the assessors needed to assess the scenes varied between two and six. In this context it must also be pointed out that it was impossible to avoid that the assessors working in the same departments had the opportunity of discussing their participation in the panel with each other. The design for the assessment experiment is summarized in Table 1.

Table 1. Design of the assessment experiment

Index	S	P	I
No. of levels	55	20	21
Size of population	55	20	∞

I = assessor
P = the statements in the measuring instrument
S = video-recorded events (scenes)

The number of scenes and the length of the assessment experiment led to two experiment leaders (EL) being used. Whether or not this has had any effect will be checked, as will the circumstance that the assessors belong to different departments and have different degrees of training in the behavioural sciences. The groupings that will be examined more closely are given in Box 5.

Box 5. The assessment panel's groupings with regard to experimental leadership, department and training in behavioural science

Principle of division	Grouping Assessor no.
Experiment leader 1	⟨1, 5, 7, 8, 9, 12, 13, 15, 17, 18, 19⟩
Experiment leader 2	⟨2, 3, 4, 6, 10, 11, 14, 16, 20, 21⟩
Department: Lund	⟨2, 3, 5, 8, 11, 12, 13, 14, 20⟩
Department: Malmö	⟨1, 4, 6, 7, 9, 10, 15, 16, 17, 18, 19, 21⟩
Training in behavioural science	
Lecturers	⟨4, 6, 7, 12, 13⟩
Assistants	⟨9, 10, 15, 16, 17, 18, 19, 21⟩
Research students	⟨1, 2, 3, 5, 11, 14, 20⟩

Finally it can be mentioned that no analysis of non-response is needed. In this study there was namely neither external nor internal non-response.

4.3 Analysis of panel assessments

If we as behavioural scientists are to be able to formulate general principles for human behaviour, our model constructions must be based on general and well-defined concepts. In the context of the importance we accord the association, structure and process paradigms as information-carrying sign systems, we shall in this chapter study whether and to what extent the relation pattern in the assessors' assessments reflect the paradigms' assumed structure of properties (see Box 4).

To this end a number of factor analyses have been carried out (see Box 6). The methods used are the principal axis method and varimax rotation. The communality has been assessed by means of the squared multiple correlation (R_i^2). This factor analysis technique has been used for testing hypotheses. In order to test whether only three latent dimensions of importance exist in the set of data and whether the statements in Box 4 correlate substantially only with the dimension that represents the respective paradigm, the data parallelepiped (see Tab. 1) has been dissolved.

In the data matrix that we have constructed, the columns represent the twenty statements and the lines the measuring objects, whereby each scene is considered a single measuring object, separate from the others. Thus the size of the data matrix is (55 x 21) x 20. (For a more detailed discussion, see Bierschenk, 1971.)

As a first measure, the distribution of the panel assessments was studied from the point of view of different break variables. But since several assessors had expressed doubt as to whether they had really been able to utilize the nine-point scale in their assessments, an investigation was also made into whether a possible dichotomization of the scale would increase the reliability of the assessors' assessments.

The comments to Table 1 also give rise to the question of whether there is empirical reason to assume that these variations have resulted in non-controllable variance. In order to test whether there are assessors who demonstrably deviate from the panel's group mean, an analysis was made

Box 6. Processing, description and analysis of data

Programme	No	Measuring object	Variable	Situation	Scaling form	
Distrib-	1	n = 21	p = 20	s = 55	nd	
utions:	2	p = 20	n = 21	s = 55	nd	
frequency,	3	s = 55	p = 20	n = 21	nd	
mean value,	4	s = 55	n = 21	p = 20	nd	
deviation	5	s = 55	n = 21	Σ p (A, S, P)	nd	
				A = Σ (2, 7, 10, 11, 13, 20)		
				S = Σ (3, 5, 12, 15, 18)		
				P = Σ (1, 4, 6, 14, 16, 17, 19)		
BMD X74	6	n = 21	p = 20	s = 55	nd	d
BMD 08M	7	n = 21	s = 55	p = 20	nd	
	8	p = 20	n = 21	s = 55	nd	
	9	p = 19	n = 21	s = 54	nd	d
	10	n = 17	p = 19	s = 54		
	11	n = 21	p = 19	s = 54	nd	d
	12	Σ p	n = 17	s = 54		d
		A = Σ (2, 7, 9, 10, 11, 13, 20)				
		S = Σ (3, 4, 5, 12, 15, 18)				
		P = Σ (1, 6, 14, 16, 17, 19)				
	13	n = 21	s = 54	p = 19	nd	
	14	n = 17	s = 54	p = 19		d
BMD 01M	15	Σ p	n = 21	s = 54	nd	
		A = Σ (2, 7, 9, 10, 11, 13, 20)				
		A = Σ (2, 7, 10, 11, 13, 20)				
		S = Σ (1, 3, 4, 5, 12, 15, 18)				
		S = Σ (3, 4, 5, 12, 15, 18)				
		S = Σ (3, 4, 5, 12, 18)				
		P = Σ (1, 6, 14, 16, 17, 19)				
		P = Σ (6, 14, 16, 17, 19)				
BMD 08M	16	Σ p	n = 21	s = 55	nd	
		A = Σ (2, 7, 9, 10, 11, 13, 20)				
		S = Σ (3, 4, 5, 12, 15, 18)				
		P = Σ (6, 14, 16, 17, 19)				
BMD 08M	17	Σ p	n = 21	s = 54	nd	
		A = Σ (2, 7, 9, 10, 11, 13, 20)				
		A = Σ (2, 7, 10, 11, 13, 20)				
		S = Σ (3, 4, 5, 12, 15, 18)				
		S = Σ (3, 4, 5, 12, 18)				
		P = Σ (1, 6, 14, 16, 17, 19)				
		P = Σ (6, 14, 16, 17, 19)				
BMD 08M	18	p = 19	n = 21	s = 54	nd	
BMD 08M	19	p = 19	n = 21	Σ s (A, S, P, E_1 E_2)		
				A = Σ (2, 3, 4, 18, 20, 28, 29, 30, 31, 32, 36, 37)		
				S = Σ (5, 6, 7, 8, 9, 11, 19, 53, 54)		
				P = Σ (10, 14, 21, 23, 38, 39, 45, 46, 47, 48, 49, 50, 51, 52)		
				E_1 = Σ (1, 15, 16, 17, 25, 26, 27, 34, 35, 40, 41, 42, 43, 44)		
				E_2 = Σ (12, 13, 22, 24, 33)		

A = association paradigm
E_1 = placebo-factor
E_2 = separation factor
P = process paradigm
S = structure paradigm
Σ = summation
d = dichotomous
n = no. of assessors
nd = non-dichotomous
p = no. of statements
s = no. of scenes

to identify so-called outliers. The agreement in the assessment panel's assessments was then studied by means of both the component and the factor analysis methods. In this way we can investigate whether the assessors' variations are defined by only one variation source or whether there are others. (For a more detailed discussion of the application of method, see Bierschenk & Bierschenk, 1976, pp. 83-84.)

4.3.1 Extraction and interpretation of factors

There are a number of different methods for the extraction of factors. The extraction method we have used is Hotelling's iterative principal axis method. This method extracts the factors successively. First an estimation is made of the loadings of the variables in the first principal factor, then the loadings in the second factor and so on. Since in this extraction method each successive factor does not take up more (and usually less) variance than the previous factor, Kaiser's criterion has been applied. Factors with eigen value (λ) that is $\geqslant$ a, when a = 1, are regarded as being significant. All others are unimportant. The way in which non-dichotomized and dichotomized assessment scales or the removal of "outliers" influences the analysis results is shown in the appendix (App. 2:2).

The non-rotated factors extracted can but need not provide a meaningful pattern from a psychological point of view. As can be seen from Table 2, the first factor appears to be a general factor, since all the statements correlate substantially with this dimension. The second factor is characterized by the fact that about half of the statements have positive loadings, while the other half have negative ones, i.e. the factor seems to be bipolar. This also applies to the third factor.

To simplify the factor structure, it has been rotated in order to approximate increasingly closely the imagined ideal structure of the factors. The rotation criterion used has been Thurstone's simple-structure. The purpose is namely to achieve a transformation of the unrotated matrix, so that the new factor-loading matrix fulfils the five conditions formulated by Thurstone (1947) as the simple-structure criterion. Since our purpose is to use the factor-analysis method for hypothesis-testing, transformation has been achieved by means of a blind-rotation of the unrotated matrix.

As is shown in Table 2, the factor-affiliation of the statements confirms our a priori hypothesis. Only two statements (nos. 1, 4) need to be re-

Table 2. Characteristics of the association, structure and process paradigms: A priori and factor analytically determined property structure

Content	No	Factor 1	2	3	Rotated I P	II A	III S	com.	A priori hypothesis
Structuring of environment	17	63	-34	-43	83	-03	08	69	P
The group's demand for adaptation	6	59	-33	-42	79	-03	06	63	P
Own actions are made conscious	14	67	-37	-29	79	-01	22	67	P
Consideration of each other's experiences	19	71	-34	-25	78	-05	27	68	P
Creation of greater interaction	16	66	-23	-26	71	-12	21	56	P
Creation of opportunities for structuralization	3	58	-15	48	18	-06	75	59	S
Creation of "Aha" experiences	18	53	-10	53	09	-08	74	57	S
Confrontation to achieve change	12	53	-12	42	17	-07	66	47	S
Correction of earlier established structures	4	61	-14	32	30	-10	64	50	P
Concentration on the whole	5	34	-07	44	00	-33	56	31	S
Sensitivity to others' viewpoints	1	62	-22	12	45	07	49	45	P
Concentration on the present	15	50	06	10	26	-27	36	27	S
Reinforcement of positive behaviours	2	41	66	-05	03	-77	08	60	A
Repetition of successful behaviours	11	44	61	-06	07	-75	10	57	A
Encouragement of desired behaviours	10	51	53	-20	07	-74	10	58	A
Search for reinforcement (interests)	7	32	62	-04	-03	-70	05	49	A
Utilization of existing habits	13	37	57	-06	04	-68	07	47	A
Distraction of attention from negative experiences	20	28	49	-07	02	-57	02	32	A
Systematic influence (successive approximation)	9	27	43	01	24	-43	05	26	A
	λ	5.16	2.88	1.63					
	%	27	42	51					

λ = eigen value
% = percentage of extracted variance

placed, and even there the intention can be discerned. Both also correlate substantially with the dimension stated by the a priori hypothesis. It is also noticeable that the statements describing the respective paradigms not only correlate substantially with the dimension in question, but also provide so-called marking variables (factor loadings ⩾ .50), with the exception however of statement no. 15. Statement no. 8 has been excluded from most of the analyses. To check whether the statement can possibly belong to the association paradigm, however, an analysis was carried out (see App. 2:2). But a check of the distributions had already indicated that the statement would lack a reliable foundation for assessment.

The rotation to a simple-structure factor loading matrix shows both all the properties that are to characterize such a matrix and a structure whose psychological interpretation noticeably agrees with the a priori hypothesis. The fact that statement no. 4, "correction of previously established cognitive structures and utilization of earlier experiences", has been looked upon as belonging to the structure paradigm is probably a result of the way in which the statement is formulated. The two concepts "correction" and "established" imply static conditions. In addition another concept that is important for the process paradigm namely "experiences", is lacking a sufficiently unambiguous causal relation. Statement no. 1, "making possible a mutual control of information", does not appear either to have been formulated in such a way as to communicate the interactive component, "sensitivity to the viewpoints of others". The wording seems to have been interpreted more with regard to preservation and maintenance of the conventional order than was really intended, namely sensitivity to the viewpoints of others with the purpose of achieving cooperation and readiness to change one's own standpoint and to permit others to change the positions they have taken up.

In summing up, it can be said that the factor structure in Table 2 gives unequivocal empirical proof of our assumption that the association, structure and process paradigms as operationalized in Box 1 have different and separate properties. In this context and taking the factor structure as a starting point, this circumstance can be expressed quantitatively. As has been assumed in Bierschenk (1976 and 1977b), the complexity of the paradigm increases, which means that the association paradigm, which is represented by the A factor, must be allotted the numerical value 1, where 1 stands for the deterministic pole of the dimension: deterministic-probabilistic. The process paradigm, which is represented by the P factor, is allotted the value 3, where 3 stands for the probabilistic pole. The structure paradigm, which is represented by the S factor, is allotted the value 2, where 2 stands for an intermediate position along this continuum.

4.3.2 Estimation of reliability of the factor structure

In Chapter 4.3.1 the abstract concept relations which the derivation and description of the association, structure and process paradigms constitute have been given an empirical anchorage. In this chapter the reliability of the empirically demonstrated factor structure will be investigated. To obtain a coefficient for maximal reliability, the alfa coefficient (α_{max}) has been calculated for the respective dimensions. α_{max} is a simple function of the largest eigen-vector of a correlation matrix for the statements included in the scale (see Box 4). The correlation matrices and both the components and the factors are given in the Appendix (App. 2:3-2:5).

As shown in the Appendix, there is a high level of agreement in the assessment of the statements defining the A and P factors. On the other hand there are clearly several latent dimensions that have influenced the assessors' use of the statements that define the S factor. But it can naturally also be so that they have given different measures of importance (weights) to the same dimension. If there are several dimensions, a study can be made of whether the assessors have been divided up into different interpretable groups. The factor structure has been examined with regard to such groupings as are mentioned in connection with Table 1. It is difficult, however, to find any meaningful interpretation of the groupings.

As shown in the appendix (Tab. 6) the first factor is responsible for the greater part of the common variance. The part contributed by the respective assessors is shown by the communality values. The components and factors shown in Appendix 2 should be interpreted as indicating that the assessors perceive as being the same the content of the statements that separate factorized scales. The α_{max} values calculated on the basis of the first component and the first unrotated factor respectively are summarized in Table 3.

Table 3. α_{max} for different factorized scales in the measuring instrument

Statements correlated with the factor	Component analysis λ	α_{max}	Factor analysis λ	α_{max}
The association paradigm				
Σ (2,7,10,11,13,20,9)	11.72	.960	11.35	.958
Σ* (2,7,10,11,13,20)	12.02	.963	11.62	.960
The structure paradigm				
Σ (1,3,4,5,12,15,18)	7.60	.912	7.19	.904
Σ (3,4,5,12,15,18)	7.03	.901	6.61	.891
Σ* (3,4,5,12,18)	7.99	.919	7.64	.913
The process paradigm				
Σ (1,6,14,16,17,19)	15.47	.982	15.20	.981
Σ* (6,14,16,17,19)	15.51	.982	15.24	.981

* The correlation matrices are given in Appendix 2:3-2:5

As can be seen from Table 3, the α_{max} values calculated on the basis of the total variance (ones on the diagonal of the correlation matrix) and the covariance (R_i^2 on the diagonal of the correlation matrix) differ very little from each other. The factors that from now on represent the respective paradigms are marked in Table 3 by an asterisk (*). In every case $\alpha_{max} \geqslant .90$, which means that the empirical anchorage of the association, structure and process paradigms fulfil the reliability requirements that can be made on good objective tests.

As far as the A factor is concerned, the reliability has been examined mainly with regard to statement no. 9. The increase in the reliability of the factor by the removal of no. 9 is admittedly negligible, but the low communality value of the statement indicates that the wording should be revised.

Based on both the factor loadings and the communality assessments, the reliability has been calculated both with and without statements 1 and 15. Without them, the reliability increases somewhat in the S factor.

For the P factor, the reliability was calculated both with and without statement no. 1. From the point of view of reliability, it makes no difference whether this statement is incorporated into the factor or not. But the factor loadings indicate that a more unequivocal wording is needed, if it is to be interpreted as belonging to the P factor.

To sum up, the analyses described above can be said to provide proof that an assessment panel of twenty-one assessors has been able to identify the properties that are characteristic of the association, structure and

process paradigms. With this background it can be established that the A, S and P factors provide an objective and reliable behavioural science base for SIR. Moreover, the reliability in the factorized scales fulfils the requirements made on good objective measuring instruments.

Furthermore, the λ values and the factor loadings (see App. 2:2) also reveal that almost every measure that has been taken to make the analysis results more unambiguous has had the opposite effect. Only two measures have contributed to a clear improvement: (1) removal of statement no. 8 and (2) reduction of the number of scenes to fifty-four. The scene (no. 55) that has been removed is a statement made by a psychologist presented in written form. (For discussion, see Chap. 5.)

5. A system for interactive behaviour simulation

Investigations (see Gibson, 1966) show that our perception of a geometric presentation of the physical world is usually extremely precise and reliable. Moreover, several independent observers need as a rule very few instructions to be able to make exact and correct observations concerning events presented in the form of pictures (see Kennedy, 1974, pp. 3-24). A study of the development of the sense organs (see Bower, 1974, pp. 141-152) shows that in our judgements and decisions we seem to work primarily from visual information. Auditive information and information mediated by the other senses take second place.

Bjerstedt's (1968) video-recorded teacher-pupil reactions were an early attempt to develop a test making use of "moving pictures" for Swedish conditions. Test situations were designed for the measurement of interaction tendencies. The test was administered together with other tests included in a group test battery. The reaction booklet for the video-recorded teacher-pupil scenes contains among other things statements on how difficult the test is judged to be and how meaningful the student teachers feel the test to be. The results given in Bjerstedt (1968, p. 22) show that the degree of difficulty is evenly spread both within the student teacher group and over differently designed versions of the test. The video-recorded version was felt by 82 % and the written version by 66 % to be "more meaningful" than the majority of the other tests (n = 166). Bjerstedt (1968) wanted to study the student teachers' general behavioural tendencies regarding different fundamental educational variables such as learning, planning a work situation or reactions to typical pupil behaviour. Our purpose, on the other hand, is to study not only the student teachers' ability to develop interactive behavioural strategies in simulated courses of events, but also the extent to which different causal variables influence the development of the behaviour strategies.

A simulation of psycho-ecological phenomena in educational environments presupposes that we know something of the factors that influence the individual's readiness to adopt roles such as teacher and pupil or counsellor

and counselled. The first attempt to develop an interactive behaviour simulator has been described in Arte (1977), Bierschenk (1975, 1976, 1977a and b) and Frost (1975, 1976). The construction model behind the development of this instrument is shown in more detail in Box 7.

Box 7. Construction model behind SIR

1. Behavioural science anchorage, where
   - 1.1 association paradigm
   - 1.2 structure paradigm
   - 1.3 process paradigm
2. Time-bounded course of events, where
   - 2.1 initial phase
   - 2.2 orientation phase
   - 2.3 exploration phase
   - 2.4 activity phase
   - 2.5 final phase
3. Task: Mother-child relationship, where decisions must be made as to whether
   - 3.1 the mother shall accompany child into classroom
   - 3.2 the mother shall not accompany child into classroom
   - 3.3 the mother should be sent home
   - 3.4 the teacher should visit the home
   - 3.5 the teacher should consult the previous teacher
   - 3.6 the teacher should consult the school's welfare counsellor
4. Personality measurements of the main actors, where
   - 4.1 measurements of the mother's personality (Cattell's 16 PF)
   - 4.2 measurements of the teacher's personality (Cattell's 16 PF)
   - 4.3 measurements of the pupil's personality (Cattell's CPQ)

5.1 Behavioural science anchorage

The primary goal in behavioural science is to describe and analyse the behaviours that characterize different systems, mainly psychological. If in this context we can for the time being accept the statement that a system can only be described in terms of observable behaviours, we must necessarily be able to agree on the conventions. With this point of departure, a system's condition is not an inherent characteristic, but every system, even SIR, is real and exists in the description we impose on the system.

The task of the A, S and P factors is to function as information-carrying variables and as such as a reference system for student teachers. The task of the reference system is to provide a set of functional limitations. Thus the student teacher must in some way be able to discover and integrate the effects of the not directly available causal variables, if he is to be able to interact with SIR. As has been seen, (see Chap. 3) the purpose of SIR is to study whether there are demonstrable covariations between the causal variables that have been built into the scenes and the student teachers' suggestions for action.

5.2 Time-bounded courses of events

Within a particular unit of time, only a limited number of interactions can occur. Thus the time variable structures the interaction process and makes it into a multi-step decision-making process. From the point of view of the student teacher or e.g. the pupil (in the form of EL's selection of scenes), SIR functions psycho-ecologically, i.e. behaviour strategies are developed on the basis of an adaptive decision-making process. The goals of both the student teacher and the EL are preliminary and are exposed to changes during the development of an interactive behaviour strategy as both the student teacher and the "pupil" learn to understand the nature of the task.

A course of events in SIR leads to increasing structuralization. The purpose of the five steps from the initial to the final phase is that it should be possible to develop in the interaction process a behaviour strategy that will lead to the pupil, who is a very shy and timid boy, being integrated into the class. But this cannot take place without the student teacher getting to know him, getting him to accept a new situation and becoming active in the class. In the final phase the student teacher then states how he can imagine his strategy continuing. However, the whole of this process is not assumed to develop with a fixed length of step and as a one-way causality with linear and irreversible relations, but it is assumed to be hallmarked by differentiation, integration, reversibility and permanence.

Differentiation is assumed to take place in relation to internal schedules to which psychological information is adapted. By means of multiple and generalizing combinations of schedules (internal representation of information), an integration should take place that will form the basis for the shaping of functions. Moreover, if it is to be possible for abstract concepts gradually to be formed, the functions must be reversible. Perception is namely not a reproduction process, but an objectifying process, for which

constancy and repetition is required (see Cassirer, 1944, p. 20).

Non-planned suggestions for action can be expected, which means that the interaction process develops "equifinally", i.e. the student teacher can reach the same final state of affairs, despite different points of departure. This mobility can be achieved partly by means of placebo scenes, which in different ways provide links within and between the same sequences that form the basic structure in SIR (see Box 9).

5.3 Task

The creation of the mother-child tie is one of the more fundamental psychological processes. If this tie has been established, then separations or breaks in the tie can create anguished reactions in both mother and child. In general two phases can be differentiated in the pattern of separation, namely (1) protest and alarming screams by which the child really shows his anxiety and, when the protest is without effect, (2) apathy, despair and withdrawal. The child shows symptoms of depression. An undisturbed mother-child tie has proved to be essential to the child's sense of security. Breaking the tie is regarded as a prototype of anxiety. Separation anxiety is described as the first "inter-personal" type of anxiety, if not the first type of anxiety of all. Studies have shown that the child's active exploration of its environment is facilitated by an undisturbed mother-child tie (see Berger, 1974, pp. 109-121; Tiger & Fox, 1971).

This fundamental relationship forms the basis for the initial scene, which states the theme of the simulator. The initial scene shows an overprotective mother with a shy child. The SIR construction builds on the assumption that the student teacher sees this and takes measures to separate the mother from the child, since the mother's presence disturbs the integration process and there is a risk that it will lead to mobbing of the child. There are several possible courses of action to be taken: The mother accompanies the child into the classroom, but the mother can also be denied entry, which in its turn creates new problems. Is she to wait in e.g. the staff room, or is she to be sent home? If the mother is sent home, it is necessary in the next phase to decide whether to visit the child's home or to contact his former teacher. After contact with the former teacher, for example, it can prove advisable to get in touch with the school counsellor or the clinic for mentally disturbed children and meanwhile let the pupil stay at home.

In his attempt to build up a suitable behaviour strategy, the student teacher is in no way forced to follow the 'tree' structure outlined above. But however the behaviour strategy is designed, the attempt at separation leads to problems that can to a greater or lesser degree be difficult for the individual student to solve in the simulator. The reactions can with increasing strength be that the pupil refuses to do as the teacher says, the pupil becomes unhappy, the pupil cries or the mother refuses to leave her son.

5.4 Personality measurements

In order to be able to study the importance of the personality for the development of interaction strategies, the three main actors in the video recorded scenes (the pupil, the mother and the teacher) have been tested by means of Cattell's 16 PF and CPQ. The importance of the personality for the development of the interaction process could be studied by means of comparison of e.g. the student teachers' assessment of the teacher's, the mother's and the pupil's personality on the one hand, and the teacher's, mother's and pupil's self-assessment on the other. In this way we could get some idea about how far the teacher's, mother's and pupil's personalities are in accordance with the intentions behind the staging of the simulator.

5.5 Staging events

Interacting with persons recorded on videotape means not only that information is mediated by means of the behaviour of individual persons, but also via the design of the scenes. In order to make the scenes as natural as possible, the staging of each separate event was discussed in detail with the teacher and class that participated in the recording. When designing the scenes, special consideration was paid to the fact that the "teacher" in the recorded scenes is only glimpsed on the TV screen. The purpose of this

arrangement was to give the person going through the simulator "room" to take over the role of the teacher. It would not have been so well-advised to eliminate the teacher completely from the screen, since "subjective" camera-work can easily create uncertainty and irritation among those who are to interact with the TV monitor. This assumption is indirectly supported by Baggaley & Duck's (1975, pp. 331-352) studies of video-presented information.

In designing the scenes, which are often very short (5-15 seconds), we have taken particular care to avoid the appearance of editorial "distortion effects". Where in a normal classroom it would be natural to have children's paintings etc. on the walls, we have as a rule chosen to have a "decorative" background. But in doubtful cases and in scenes that could easily be used in other contexts, we have chosen a "neutral" background. By double-printing and the choice of different "irrelevant" or abstract backgrounds, demonstrable effects that seriously undermine the intended communication effect of the information can namely arise, as is shown in Baggaley & Duck's (1975) experiment.

Another editorial manipulation effect that we have been particularly aware of is the use of close-ups and zooming. The choice of picture can create the illusion that a person is e.g. tense or relaxed. In addition it is possible by means of arhythmic changes of picture to give the impression that a person is talking diffusely and incoherently. By choosing the right moment for changing a picture, a statement can be structured so that the communication effect is markedly increased. In choosing close-ups we have as far as possible kept to showing the person half-size. As far as the other possibilities for technical manipulation are concerned, we hope that we have been able to minimize the influence of undesired effects. Finally it should be mentioned that our action-oriented behaviour simulator with very short scenes and a demand for a suggested course of action after each scene appears to counteract the attempts made by the student teachers to passively watch television and to become involved, i.e. their attempts to create subjective references.

In SIR an event is made concrete by means of a video-recorded situation (or scene). Each information-carrying variable is represented by a number of events, while the cues that have been built into each separate scene form the affordance-structure in an event. The number of information-carrying cues that an individual can perceive simultaneously is given by Miller (1956) as being 7 ± 2. The number of cues that we have built into the separate scenes varies between one and eight.

After each scene has been shown, the student teacher estimates to what extent the event's affordance-structure covariates with his own cognitive models. Depending on the result of the estimation after a scene has been shown, the student suggests a course of action and a new scene is shown. The analysis of this interaction process will eventually lead to a mapping of how far the student teacher's development of a behaviour strategy is sensitive to behavioural science paradigms that presuppose (1) external steering and control, (2) internal steering and control and (3) rules for logical operations.

In conclusion, a brief concrete example will be given of how SIR functions in practice. (The example follows the outlined principles given in Fig. 1, p. 14.)

We start with background information, which can look like this:

You are to imagine now that you are starting this term with a new 4th grade class. The headmaster has informed you that one of the new pupils in the class, Göran Larsson, comes from a remedial class. Intellectually Göran is normal, but he is very isolated and anxious. It is the first day of term and you are on your way from the staff room to the classroom.

An initial scene then illustrates the event that takes place outside the classroom door. - Mrs. Larsson and Göran are sitting there on two chairs. The mother introduces herself as Mrs. Larsson and says that she is Göran's mother. You greet the mother, but Göran refuses to respond. The mother says: "Göran is terribly frightened, I don't think he will dare stay in the class when I go."

Here the scene is broken off and you are asked to suggest a course of action. You could say, for example: "I try to make contact with the boy, but the mother might as well come in too", or something similar.

After your suggestion, a new event (i.e. the leader of the experiment shows a new scene) takes place, which shows the consequence of the action you have proposed. After Göran has reacted in some way, e.g. by looking down at the floor when you start talking to him, the scene is broken off again.

In this way you continue your interaction with the simulator up to the point when you have succeeded in making Göran respond positively to your attempts to make contact with him.

It is characteristic of this simulation that it corresponds to a high degree to what happens in a normal teaching situation. There is no immediate feedback with regard to the teacher's "correct" behaviour. What makes this simulation experimental, however, is that the events have been simplified and compressed time-wise. But for the purpose of training this is, according to Kersh (1963, p. 10), preferable to a realistic teaching situation, since the student teachers can be expected to relax more, which should increase their ability to analyse simulated courses of events.

6. Information-carrying cue systems in the scenes

By constructing an interactive behaviour simulator, anchored in different behavioural science models, we hope to be able to study whether and to what extent the implicit cognitive structure of individual people can be approximated by means of these models. If we assume that all exchange of knowledge and information between people can only take place within certain tolerance limits (defined through implicit models), a study of the basic structures of different cognitive systems should be of fundamental importance for all educational activities.

During the spring term of 1974, the student teachers' suggestions for action were collected and served during the following term as a basis for the design and staging of about 40 different events. Each separate scene and its theoretical anchorage has been described in Frost (1975). During the spring term of 1975 SIR was tested, in order to provide information about (1) how the student teachers experienced SIR and (2) what comments the video-recorded situations produced. By an empirical test we also wished to find out (3) what suggestions for action were made and (4) whether the scenes that are shown as a consequence of the suggestions lead to logical and consistent chains of events. In addition we wanted to know (5) whether the background information that places the simulator in its context is adequate and (6) whether SIR functions flexibly enough or (7) if we need to create further auditive and visual information to achieve easy transitions between the scenes. Finally this test was intended to provide information about (8) the extent to which there is a structure in the sequences of actions created by the student teachers that indicates anchorage in the association, structure or process paradigm.

In the first phase of the construction, the association of the scenes with the respective paradigms has taken place a priori. In this chapter, however, a study will be made of whether the assessment panel that was presented in Chapter 4 has been able to place the scenes in the model stated in our a priori hypothesis. Another part of the construction work that requires an empirically anchored systematization is classification of suggested actions.

By means of various testings, we hope to acquire so many suggested actions that we shall be able to develop a schedule for classification and selection of scenes under more controlled conditions than is possible in the first phase of testing.

6.1 Instrumental arrangement

The experiment room consists of a small TV studio and control-room. In the experiment room there is a table with a microphone. The voice of the person participating in the experiment (S) is recorded on tape at the same time as it is transmitted into the control-room. The S sits at a suitable distance (about 2.5 m) from two TV-monitors. The right monitor shows the S herself as she interacts with the simulator. The left monitor shows the situations that require the S to suggest a course of action. In the experiment room there is also a visible camera with a fixed angle. This films the S as she acts. Another camera diagonally behind the S records the scenes shown on the left TV monitor. By means of these arrangements, we have made it possible to show the S simultaneously both her own actions and the scenes that have been shown.

In the control-room there are separate video-cassettes arranged on mobile shelves. So as to be able to adapt flexibly to the S, we recorded on separate video-cassettes situations that can arise from the S's suggestion for action.

After the initial scene, which is shown on a video-cassette recorder, separate scenes are placed in the recorder as the action continues. By means of a microphone in the control desk, EL can contact S and give directions if necessary and by means of a control monitor check what takes place in the experiment room visually. Two video-recorders record both the S and the scenes shown in the experiment room.

This experimental arrangement and an example of how an S can be expected to build up a strategy of action have been recorded on a video-cassette in English, German and Swedish. The cassettes can be obtained from the author.

6.2 Experimental design: Test 1

In the first testing of SIR, the experiment persons (Ss) consisted of 24 student teachers from the second term (M2) of the line for class teachers for grades 4-6. The design and results of the test are given in Frost (1975), and consequently we can simply give a short resumé here:

The Ss understood the background information and the problem posed by the simulator in a uniform way. The scenes were understood and interpreted similarly. In addition they were felt, with a few exceptions, to be realistic. The scenes shown in connection with a suggestion for action were judged to be a logical and consistent consequence. As a rule it seems to have been easy to make contact with the simulator, since most of the S spoke directly and acted. Our concluding interviews with the Ss show clearly that they prefer meeting this type of problem situation in a simulator to having to act in reality. They consider that the course of events and the measures taken in a real situation would "with great probability" have been the same as the course of events and the measures taken in SIR. The Ss who, during the testing of SIR, saw themselves acting in the simulator were generally positive to this type of self-confrontation experience. Externally mediated self-confrontation via CCTV/VR seems to make the Ss clarify their suggestions for action. Another result of the self-confrontation experiences is that Ss, when meeting difficulties in the simulator, objectify in their comments, i.e. they speak of themselves (the teacher) as object, while without this opportunity they speak of themselves as subject. By letting the Ss become their own "external observers and commentators", we seem to be given new opportunities for systematic process analysis and behavioural training under controlled conditions. Box 8 presents some authentic steps in the development of a strategy of action, together with the S's comments during the self-confrontation phase.

6.3 Experimental design: Test 2

On the basis of the experiences we gained from the testing of the first version of SIR, SIR was expanded and revised. A detailed description of the results of this revision and testing is presented in Frost (1976). A total of 55 scenes have now been recorded on video-cassettes and anchored in the association, structure and process paradigms.

During the spring term of 1975, a new experiment was carried out, for the purpose of providing information as to how the revised version of SIR functions. In this test 10 student teachers participated, five from M2, so as to maintain the continuity from the first testing and five from M6, since we wanted to see how more experienced student teachers acted in the simulator.

The results from this second testing agree in all essentials with those from the first testing. In Test 2 we could again establish that the Ss have in general a positive attitude towards the SIR and that they feel the scenes to be logical and consistent consequences of the given suggestions for action. During Test 2 we also tested our working hypothesis that implicit cognitive models define the S's limit of tolerance concerning situation-conditioned information that is accepted or rejected respectively. The results show that from the S's point of view illogical or improbable situations that are shown as a consequence of a suggested action lead to frustration and confusion on the part of the S and to the S regarding the simulator with scepsis. No difference between the Ss way of working with SIR resulting from different length of training could be traced, however.

6.4 Panel assessment

Cues are built into the scenes that to a greater or lesser degree refer to the paradigms described. If we can use an assessment panel (see Chap. 4) to operationalize the affiliation of the scenes to their respective paradigms, it will also be possible to describe the properties of SIR quantitatively. Based on this quantification, we can then describe an interactive behaviour simulation by means of a state vector, $X_1, X_2, \ldots, X_N$. (For further discussion, see Chap. 7.)

The set of scenes that the assessment panel was asked to judge represents 55 different events. They are our choice to represent a teaching process. As is known, this is a very complex process, but the structure of the process need not be complex. The main aim of having a panel assessment of the behavioural science content of the scenes is to convert non-explicitly formulated and often not even noticed teaching goals of a psychological nature into a precise and analyzable procedure. A description of the set of scenes is given in the Appendix (App. 1). For a description of the

a priori assumed theoretical anchorage of the individual scenes, see Frost (1976), while the structure is presented in Box 9.

Box 8. Suggested actions, description of scenes and comments during the self-confrontation phase

Suggested action	Scene-description	Comments during self-confrontation phase
	No. 37 You and Göran are sitting side by side talking to each other. You ask him: "What's it like being new in school?" He replies shyly "don't know". You ask him if he's got to know anybody in the class. He quietly answers "Stefan". You say that you've heard that he likes reading and ask him what he likes reading best. He says that he likes reading different kinds of things. You ask if he likes Asterix. His face lights up and he answers yes. You ask him which of the characters he likes best. Göran answers: "Obelix, because he's always fighting".	
Got Göran to sit in a group. Had let Göran's mother join him at the beginning, but then the mother should leave Göran.		That suggestion was a little too quick. Would not have let the mother join Göran in the classroom. It would have been better to let Göran try on his own. Here it is pointed out too strongly that Göran needs his mother.

Box 8. (Cont.)

Suggested action	Scene-description	Comments during self-confrontation phase
	No. 75 You suggest that Göran sits with Stefan and 3 other pupils in a row of desks. The mother goes with Göran to his desk. Hesitantly Göran sits down. His mother draws up a chair and sits down next to him.	
	No. 69 You say hello to the mother who introduces herself as Mrs Larsson, Göran's mother. You turn towards Göran and say "Hello". Göran doesn't say anything, but instead turns towards his mother. The mother says: "Göran is so terribly frightened. I don't think he'll dare to stay in the class if I'm not there.	
Tried to talk to him and making contact. Promising: You'll see, all will be o.k.		Appear to be tense and nervous. Experience the situation as tense and uncomfortable. What I'm saying sounds unnatural which was caused by my nervous state.
	No. 70 You turn to Göran and try to encourage him by saying: "I'm sure everything will turn out all right. Everyone in the class is so nice and friendly."	
Had let him take a look at the class and tell him something about the class. Had made him calm so that he is not so frightened.		Should have had a talk with the mother before to get some information about Göran, e.g. how he was in his former class.

Box 9. A priori structure in SIR

	Association paradigm Scene no.	Structure paradigm Scene no.	Process paradigm Scene no.
Initial phase	70	8	73
Orientation phase	71	72	78
Exploration phase	62	10	65
	63	36	79
		83	80
		11	81
		84	
Activity phase	55	82	38
	56	37	74
	57	12	75
	35	13	21
	53	14	76
	58	15	77
Final phase	16	16	16
Extra scenes	2	43	42
	3		45
	5		51
	6		20
	25		
Neutral scenes: Scene no.	47, 61, 23, 24, 41, 60, 64, 18, 59, 69		

For the time being it is assumed that the set of scenes presented in Box 9 is exhaustive. All the events that could come about as a result of the action suggested by the student teachers are assumed to be included in the set of scenes.

6.5 Analysis of panel assessments

Against the background of the information-carrying cue systems built into SIR, the hypothesis that the scenes belong to four different and orthogonal latent dimensions will now be tested. The scenes that in Box 9 are presented under "the association paradigm" contain a priori such information-carrying cues as are characteristic of the paradigm and should thus correlate highly with one and the same dimension. The scenes presented under "the structure paradigm" should have a correspondingly high degree of correlation with another dimension and a low degree with the former. The scenes presented under "the process paradigm" should have a high correlation with a third dimension and a low correlation with the first and second. The scenes that will have a high correlation with a fourth dimension and a low correlation with the three first ones will, taking the behavioural science anchorage into consideration, be regarded as "information-less", i.e. as placebo scenes.

To test this hypothesis empirically, the data parallelepiped that is defined in Table 1 has been taken apart, so that the scenes are represented by the columns in the data matrix, while each statement is regarded as being one measuring object, separate from the others. This breaking down leads to a data matrix of the size 420 x 55. The correlation matrix that forms the starting point for our factor analytical testing of hypotheses is presented in the appendices (App. 3:1). The correlation matrix is based on 19 statements, 21 assessors and 54 scenes. The reasons for taking away one statement (no. 8) and one scene (no. 55) has already been given (see Chap. 4. 3. 1).

6.5.1 *Extraction and interpretation of factors*

Factors have been extracted and rotated in the same way as has been described in Chapter 4. The results of the factor analysis are given in Table 4. As shown in Table 4, the analysis has led to five factors fulfilling the criterion $\lambda \geqslant 1.00$. The scenes that correlate highly with the first four factors supports our a priori hypothesis, while the fifth factor has not been predicted. But nonetheless it can be given a psychologically unambiguous interpretation. The factor is defined by all the scenes that make up the teacher's attempt to separate mother and son and thus appears to represent "the separation task" in SIR.

One of the characteristic features of the analysis is that it can be given a psychologically unequivocal interpretation. For each factor the only scenes showing high loadings are those that according to the a priori hypothesis correlate with the respective dimension. Another typical feature is that all the extra scenes and all the neutral scenes correlate with the fourth dimension if only four factors are extracted. The scenes that now correlate with Factor V are in this case loaded exclusively in the fourth factor.

A factor analysis was also carried out to check the importance of the removal of scene no. 55. The analysis results show that the removal of the non-staged psychologist's statement leads to a more unequivocal factor structure. Indirectly this result also supports the discussion conducted in Chap-

Table 4. Non-rotated and rotated factor structure in video-recorded situations: Scenes

Seq. no.	Scene no.	Content	Factor (unrotated) 1	2	3	4.	5	Factor (rotated) I P	II A	III S	IV E	V	com.	A priori hypothesis
36	62	Teacher tries to find out what Göran is interested in (maths?)	27	72	-13	29	03	-11	81	04	09	-12	69	A
18	35	Teacher suggests that the class does some maths (with the mother)	29	58	-12	25	13	-03	71	03	-04	-01	51	A
28	53	Teacher suggests that the class does some maths (without the mother)	29	56	-11	21	18	-04	69	02	-03	06	49	A
4	6	Teacher promises Göran he can look after the aquarium	39	56	-06	18	21	-01	71	09	-09	13	54	A
30	56	Mother and Göran sit down	43	55	-21	01	-04	06	63	-06	-34	-02	53	A
32	58	Teacher suggests that the class does a painting of the summer (with mother)	31	53	-16	16	16	01	67	-02	-08	06	45	A
20	37	Teacher talks to Göran about Asterix	38	53	07	34	03	-02	68	29	-07	-06	55	A
37	63	Teacher asks Göran what he interested in (maths?)	35	57	-05	13	-16	-05	61	11	-30	-15	49	A
3	5	Teacher shows Göran the fishes, Göran looks shyly	42	56	-15	-09	04	00	61	-06	-37	11	52	A
31	57	Teacher suggests that the class does a painting of the summer	27	46	-22	18	23	05	63	-07	01	09	42	A
2	3	Aquarium: "Perhaps you have one too?"	47	47	-06	13	-07	08	59	15	-29	-05	47	A
29	55	Teacher tries to distract, shows the aquarium	38	54	-19	-14	00	-00	56	-12	-39	08	49	A
5	8	Göran stands close to his mother and looks down at the floor	38	-02	49	02	-04	02	01	57	-20	16	39	S
19	36	Teacher talks to Göran's former teacher about him	36	02	64	24	-09	-03	07	76	-10	05	60	S
7	11	Teacher visits Göran's home	40	-12	60	24	-21	08	-04	78	-15	-04	64	S
6	10	Teacher talks to school welfare consellor about Göran	39	-15	60	14	-07	07	-07	72	-15	-04	55	S
54	83	Teacher talks to mother at school	49	-18	49	17	-07	21	-02	68	-14	11	54	S
11	15	Teacher talks to mother on telephone	48	-15	44	25	-02	23	05	67	-06	10	51	S
8	12	Teacher lets the class draw their families	42	-08	37	19	09	18	10	54	-03	18	37	S
53	82	Teacher has a private talk	54	06	25	26	-10	24	27	53	-17	-01	44	S
9	13	Teacher lets Göran talk about the figures in his drawing	33	22	27	28	16	02	37	42	05	13	33	S/A
48	77	Teacher tries dice game + Stefan	55	-50	-34	13	06	83	03	04	-01	09	69	P
50	79	Teacher tries contact exercise: A ship ... (with mother)	61	-37	-32	17	04	79	10	08	-05	06	65	P
51	80	Teacher tries contact exercise: A ship ... (without mother)	58	-43	-33	09	10	79	02	-03	-04	15	65	P
52	81	Teacher tries contact exercise: Sawing in pairs (without mother)	51	-50	-28	11	03	77	-08	07	-02	08	60	P
47	76	Teacher tries to get Göran to function: Collage + Stefan	62	-35	-31	06	06	75	08	05	-13	13	61	P
14	21	Teacher tries to get Göran to function: Collage	43	-44	-40	23	05	76	02	-02	10	-01	59	S
23	42	Göran is given a seat by the door	60	-46	-20	02	-16	74	-11	15	-23	-00	64	P
39	65	Teacher suggests that class makes tour of school	62	-40	-15	-06	-16	67	-09	16	-32	05	59	P
45	74	Teacher tries to introduce Göran into group of pupils (without mother)	59	-39	-13	-01	09	66	-03	15	-14	23	53	P
21	38	Teacher conducts a group conversation	53	-17	-29	36	-14	65	24	16	-03	-20	55	P
49	78	Teacher introduces the appointed sponsors	60	-28	-23	-02	00	65	06	07	-22	13	49	P
10	14	Teacher wants to try to let Göran act a part	34	-46	07	15	-02	47	-19	30	03	05	35	S
46	75	Teacher tries to introduce Göran into group of pupils (with mother)	56	-09	-14	01	01	47	18	12	-23	12	35	P
38	64	Noisy class: Aren't we going to start soon?	27	-33	-09	-04	05	40	-14	04	-05	13	20	N
1	2	Look at aquarium from the door into the classroom	46	40	04	-36	-15	-03	32	04	-64	14	53	E (A)
34	60	Göran says: I don't want to	42	11	13	-31	-12	08	08	15	-50	17	32	E (N)
44	73	Göran and his mother stand outside classroom door. Teacher: Come in	68	-05	07	-23	05	38	14	22	-44	34	53	P
42	71	Teacher shows the class: Making physical contact	48	13	-01	-36	-24	16	11	05	-62	08	43	A
17	25	Mother holds Göran tenderly near the aquarium	47	50	-15	-15	-12	05	53	-04	-50	02	54	E (A)
41	70	Seeking contact: Good friends	40	35	01	-32	-22	-02	26	03	-60	05	43	A
15	23	Göran stands inside the room: Unhappy	32	05	05	-28	-05	09	03	05	-38	18	19	E (N)
16	24	Göran stands inside the room: Cries	26	12	06	-21	-15	03	07	07	-37	04	15	E (N)
43	72	Teacher suggests that Göran and his mother listen to the class	48	11	-05	-26	-11	21	16	05	-48	13	33	S
27	51	Teacher suggests that the pupils say their names (with mother)	49	-13	-02	-06	-15	38	04	18	-32	04	29	E (P)
25	45	Teacher introduces the new pupils	52	-15	02	-14	-34	38	-05	22	-48	-06	43	E (P)
35	61	Teacher puts arm round Göran's shoulders: It will be all right	40	28	-04	-17	-21	07	27	05	-48	-02	32	E (N)
26	47	Teacher asks: Where did Göran go during the break	30	-19	23	06	21	20	-02	32	04	28	22	E (N)
40	69	Initial scene	24	04	07	-14	-17	06	02	11	-31	-00	11	E (N)
12	18	Teacher asks mother to leave the classroom	31	-08	35	-31	47	01	-03	23	-11	69	54	E (N)
33	59	Teacher says: Goodbye, Mrs. Larsson. Göran half-rises	38	-11	18	-32	47	15	00	12	-13	68	52	E (N)
13	20	Class (group pressure) is used in the farewell scene	40	-20	08	-28	38	27	-03	08	-14	58	43	E (P)
24	43	Teacher says that the mother is to go home quietly	53	04	19	-36	22	15	11	19	-39	52	49	E (S)
22	41	Mother is sent home: Not suitable for her to stay	50	16	10	-21	30	14	29	14	-27	48	42	E (N)
		λ	10.86	6.78	3.55	2.38	1.60							
		%	20	33	39	44	47							

ter 4.2. Ecological information that is presented in the form of video-recorded events leads to more precise and reliable observations than appears to have been the case with ecological information presented in written form.

To sum up, the results in Table 4 can be described in the following way: The scenes in which the affordance-structure refers to the association paradigm also mainly define Factor II or Dimension A. Only two scenes show high correlation with Factor IV. These will be regarded in future as placebo scenes. The same applies to the scenes that prove to be marking scenes (factor loadings $\geqslant .50$) for Factor IV, although there are also correlations $\geqslant .30$ with Factor II.

The scenes whose affordance-structure refers to the structure paradigm also define in all essentials Factor III or Dimension S. There are, however, two scenes (nos. 10, 14) that a priori belong to Factor III. The factor loadings show, however, that they are affiliated to the process paradigm. Scene no. 9 can a priori be affiliated to both the structure and the association paradigms. The same result is shown by the factor loadings. But since the scene correlates somewhat more highly with Factor III than with Factor II, it has been placed with the structure paradigm. Scenes no. 43 and no. 24 seem to be "information-less" and will be regarded from now on as placebo scenes.

The scenes that define Factor IV or Dimension E have a priori been considered "information-less", and this has been confirmed. The same applies to Factor V, which is defined by the scenes that concretise the teacher's attempts to separate mother and son. As such it should be possible to use the scenes within any paradigm, since the separation task should not normally be linked to any definite behavioural science starting-point. In this way Factor V is really a confirmation that we have succeeded when constructing the simulation in keeping the separation scenes apart from any anchorage in any of the three paradigms. Thus succeeding with the separation task is wholly independent of a particular starting-point in SIR or a particular behavioural science point of view.

6.5.2 Estimation of reliability of the factor structure

The factors shown in Table 4 should be looked upon as condensed statements about the linear relations that exist between the information-carrying cues

that have been built into the scenes. The factor analytical testing of the a priori hypothesis about the behavioural science anchorage of the scenes (the scenes' latent dimensions) has only in 11 % of the cases led to a regrouping. Thus the empirical analysis shows very good agreement with the theoretical analysis on which the behavioural science anchorage of the scenes is based.

The scenes that correlate with the respective dimensions are also in most cases marker scenes, which permits unequivocal statements about the affordance-structure that characterizes each scene. Factor loadings resulting from a varimax rotation are moreover relatively invariant with regard to various random samples of persons and properties.

Since our purpose is to draw conclusions about the way in which our paradigms steer the development of a behaviour strategy in SIR, we shall now look more closely at the reliability of the factor structure, the factors and the individual scenes. Table 5 gives the reliability for both the entire set of scenes and for the separate factors, while the correlation matrices and the factor analyses are given in the Appendix (App. 3:2-3:8).

Table 5. α_{max} for different factorized scales in the set of scenes

Scenes correlated with the factor	Factor analysis λ	α_{max}
Set of scenes, total	12.38	.965
The association paradigm Σ (2, 3, 4, 18, 20, 28, 29, 30, 31, 32, 36, 37)	8.42	.925
The structure paradigm Σ (5, 6, 7, 8, 9, 11, 19, 53, 54)	6.35	.885
The process paradigm Σ (10, 14, 21, 23, 38, 39, 45, 46, 47, 48, 49, 50, 51, 52)	9.03	.934
The placebo dimension 1 Σ (1, 15, 16, 17, 25, 26, 27, 34, 35, 40, 41, 42, 43, 44)	5.41	.856
The placebo dimension 2 Σ (12, 13, 22, 24, 33)	4.69	.826
The placebo dimension 1 and 2	4.96	.838

As can be seen in Table 5, the reliability is generally very high. For the whole set of scenes α_{max} is .97. With regard to the information-carrying cues built into the scenes, we can establish that the judgements are objective and that they show very high reliability. The reason why the reliability of the placebo dimension is somewhat lower is primarily that there are some scenes that correlate substantially, also with factors A, S and P, which indicates that they contain weak cues of paradigmatic information. It should be possible to replace these scenes gradually with scenes that correlate more unambiguously with the placebo dimension. In SIR it should be possible to show each scene independently of the others, while at the same time each scene should contain all the information-carrying cues that are to influence the student teacher's decision and suggestion for action. Moreover only and exclusively one scene can be shown at a particular point in time in the development of a course of events. In this context the reliability of the individual scenes is also of interest.

A reliability gauge that is directly accessible in a factor analytical study is the communality assessment, h_j. The h_j values given in Table 4 can be regarded as an approximate reliability gauge for the individual scenes. A lower limit for the reliability of the scenes defines the multiple correlation squared. The multiple correlation of the individual scenes is given in the Appendix (App. 3:1). In this context it should also be mentioned that in the cases in which there are two or more rotated factors, no trace has been found of any of the groupings presented in Box 5.

In conclusion the information-carrying cue system in SIR can be said to fulfil the demands made on objective instruments.

7. Explorations in adaptive behaviour simulation

Experiments can often be made meaningful by the use of statistical design and principles of repeated measurement. If, however, there are observations arranged according to a time variable, methods for an analysis of stochastic processes are required. The first question we are seeking to answer is whether and to what extent the latent dimensions proved in Chapter 6 influence the development of a course of events in SIR.

One method for testing whether systematic effects exist in one of chains of events generated by the student teachers or whether it is completely random, is the run test in its various versions (see Hoel, 1962, pp. 335-345). The run test only discriminates, however, between the total number of "runs" (run = a sequence of identical signs that are preceded and succeeded by another sign or no sign at all) and what can be expected. But this type of test is inefficient for differentiating between other types of non-strictly random courses, e.g. time-bound ones.

Adaptive behaviour simulation means that the observations (the scenes) have been arranged with regard to an interval of time and the evaluation refers to an analysis of the consequences that each separate suggestion for action has had for the student teacher in his interaction with SIR. The development of an authentic course of events is exemplified in Figure 2. When the scenes are arranged according to a time interval and the time interval is irrelevant, no covariation should be expected.

The observations from Tests 1 and 2 (see Chap. 6) will be used to study whether any of the paradigms has steered the development of a course of events in SIR. This is possible partly because the factor analytical test (see Chap. 6) has confirmed our a priori hypothesis and partly because the assessment of the affordance structure of the scenes has a very high degree of reliability.

We can state a condition (T_{ij}) for pairs of suggested actions (H_i) and scenes (S_j). In this way we can construct a condition matrix that can be looked upon as an expression of the implicit cognitive events that are assumed to take place when S chooses the alternative action A_i as the best alternative and S_j

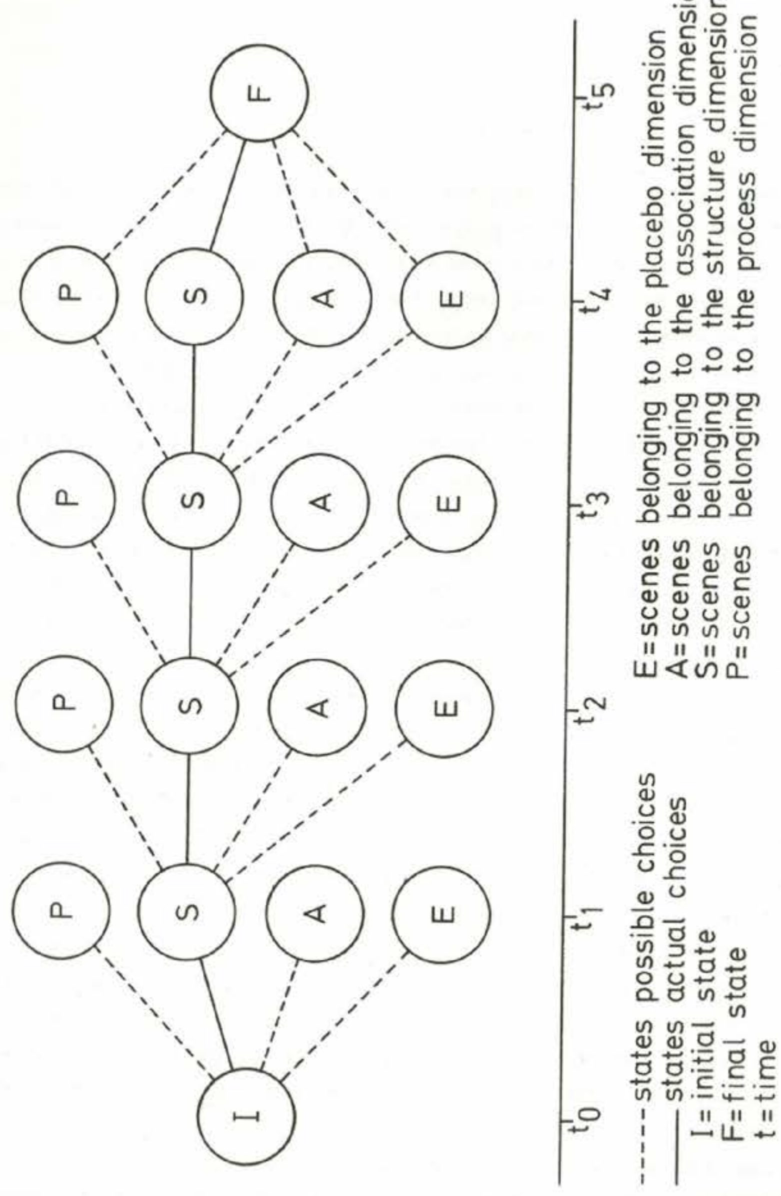


Figure 2. Transitions in an adaptive behaviour simulation (see S1, Tab.5)

follows as the most probable consequence of A_i.

7.1 Coding of scenes and quantitative definition

When SIR was tested for the first time it produced the chains of events that are presented in Table 5. For each (H_i, S_i) pair, an implicit cognitive event has been produced, which means that the cells in the matrix represent the state of the simulation process.

Table 5. State matrix: A priori coding of the scenes from Test 1

Experiment subject	Steps in a stochastic process 1	2	3	4	5	6	7
1	S	S	S	S			
2	S	A	A	E			
3	S	S	A	E			
4	S	S	S	A	A		
5	S	A	A	A			
6	A	A	E				
7	A	A	S	P			
8	S	P	S	P	S		
9	P	A	A				
10	E	S	A	A	P	P	
11	E	A	A				
12	P	P	P	E	S	P	P
13	P	P	P	E	A		
14	S	S	A	E	A	E	

A = scene belonging to the association paradigm
E = placebo, i.e. scene not belonging to A, S or P
P = scene belonging to the process paradigm
S = scene belonging to the structure paradigm

The sequences of letters in Table 5 represent a stochastic process. S1, for example, produces a suggestion for action (H_{1i}). This suggestion for action has scene (S_{1j}) as a consequence. S2 produces H_{2i} which is followed by S_{2j} as a consequence and so on, together with associated probabilities. This process is repeated for each individual participant in the experiment. The revised form of SIR, Test 2, resulted in the state matrix presented in Table 6.

Table 6. State matrix: A priori coding of scenes from Test 2

Experiment subject	Steps in a stochastic process 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	S	A	A	S	S										
2	A	A	E	E	E	A	A	S	E	E	E	E	S		
3	A	A	A	E	E	E	S	P	E	A	S				
4	S	E	A	E	A	A	S	S							
5	E	E	S	A	E	E	E	E	E	A					
6	E	S	A	P	P	A	S	P							
7	E	E	A	E	E	P	E	E	S	E	A	P			
8	S	E	S	S	S	A									
9	A	A	P	P	E	E	S	S	S	E	P	S			
10	A	A	E	E	E	A	E	P	P	E	E	E	E	S	S

A = scene belonging to the association paradigm
E = placebo, i.e. scene not belonging to A, S or P
P = scene belonging to the process paradigm
S = scene belonging to the structure paradigm

Starting from the simulation results presented in Tables 5 and 6, we shall now test whether the scene shown on one occasion belongs to the same paradigm as the scene shown immediately before. For if the pairs of scenes lying close together in time prove to have the same values, this leads to a covariation that differs demonstrably from zero.

It can be difficult to quantify the sequences of letters, especially when the quantification can be done in several different ways. One starting point for a quantitative determination can be the degree of determinism in the paradigm. The association paradigm is based on the causality assumption and is perceived, compared to the structure and process paradigms, as the most deterministic. The relationship applies between the structure and process paradigms: Since maturity plays a larger role for the structure paradigm, it is regarded as being more determinististic than the process paradigm. If the paradigms are arranged along a dimension with the poles deterministic-probabilistic, this relationship can be expressed quantitatively with figures, where

A = 1, S = 2 and P = 3.

A quantitative definition of the placebo scenes remains. By definition the scenes are "empty" (E) as far as signs referring to the properties that are characteristic of the paradigms. For this reason the E-scenes are given the value zero, i.e. E = 0.

In order that we might study the way in which the association, structure and process paradigms have influenced the simulation process's state, the state matrices (Tables 5 and 6) are transformed to so-called transition matrices.

7.2 Analysis of transition matrices

The simulation process (Fig. 2) begins in "I" and finishes in "F". In this case it has generated scenes belonging to the structure paradigm. Working from the quantitative determination presented in Chapter 7.1 a closer study will be made now of the scene sequences generated by the Ss during Test 1. The way in which the simulation process has changed from one state of affairs to another is reflected in the transition matrix presented in Table 7.

Table 7. Transition matrix for the scene sequences from Test 1

From state (i)	To state (j) I	0	1	2	3	Σ
I		2	2	7	3	14
0		0	3	2	0	5
1		5	9	1	1	16
2		0	6	7	4	17
3		2	1	2	6	11
Σ		9	21	19	14	63

I = initial state
i = state preceding in time
j = state following in time

The state markings in Table 7 tell us that the simulation process goes from state i to j. The cells with the I sign give the state of the process after the Ss's first suggestion for action. The total number of states that precede a state is achieved by adding the rows, while the total number of states following a suggestion is gained by the sums of the columns.

The state that is most characteristic of the simulation process can be crystallized by localizing the largest number of markings in both the rows and the columns. As can be seen in Table 7, the association paradigm has had the greatest influence, though it has only one marking more than any of the others.

The length of a state in which the simulation process finds itself is shown by looping, i.e. all cases are isolated for which there is an entrance into both cell (i, j) and cell (j, i). Thus the length of different states can be read from the diagonal in the transition matrix. The scene sequences that contain no looping tell of a buffer effect in the flow of ecological information (for discussion, see Hare, 1967).

Taking Table 7 as a starting-point, we shall examine whether there are any answers to the following questions:

1. Does one state more often precede than any other?
   This question can be answered by comparing all row entrances (r) with the column entrances (k). But since $r_n < k_n$ the answer to the question

is No.

2. Is there any state that more often follows than precedes another one?
The answer to this question is Yes. The A scenes seem more often to follow than to precede anything else.

3. Which state shows the greatest variation regarding whether it precedes or follows anything else?
The answer to this question is that states based on the association paradigm seem most often both to precede and follow.

4. Is there any state that never (a) precedes or (b) follows anything else?
The first part (a) can be answered by No while the second part of the question (b) must be answered by Yes. In the simulation process E scenes never seem to follow the same type of scene. Moreover, a P scene never seems to follow an E scene.

5. Are there states that differ regarding the length of the state?
To this question we can answer that there seem to be E scenes that express a buffer effect in the ecological flow of information. There is namely no looping at all.

Test 2 was carried out partly to study whether the revised and newly constructed scenes fulfilled their function, and partly to find out how important it is that the Ss are allowed to see that the "right" event occurs as a consequence of a suggested action. Keeping these purposes in mind, a closer examination will be made now of the state matrix that is the result of Test 2. The way in which the simulation process has changed from one state to another is presented in Table 8.

Table 8. Transition matrix for the scene sequences from Test 2

From state (i)	To state (j) I	0	1	2	3	Σ
I		3	4	3	0	10
0		21	8	8	3	40
1		7	8	5	3	23
2		5	4	7	2	18
3		4	1	1	3	9
Σ		40	25	24	11	100

I = initial state
i = state preceding in time
j = state following in time

Taking Table 8 as starting point, questions 1 to 5 will also be answered for Test 2. The first and second questions can be answered with Yes, sinc $r_n = k_n$. Now a neutral state seems just as often to precede something else In addition for question 3 the answer can be that the neutral state shows th greatest variation, since it most often both precedes and follows another state. The first part of question 4 can be answered with Yes. The simulati process has never generated a P scene immediately after a P scene.

Finally question 5 can be answered by saying that the simulation proces has for the greatest length of time been in a neutral state, since the diagor shows the greatest number of loopings.

In summing up it can be said that during Test 1, the simulation process appears to have been in a state that indicates the steering effects of the as ciation paradigm. During Test 2, on the other hand, the simulation proces seems to have mainly been in a neutral state. These results can be explair in the following way. The student teachers that took part in Test 1 had, a short time before the experiment was carried out, discussed stimulus-response theories (according to oral information received from lecturer Pe Sundgren, Malmö School of Education). This can have led to a preference for such information-carrying signs as refer to the association paradigm. The purpose of Test 2 was among other things to test the student teachers' "tolerance limit" regarding which scenes are accepted as a probable consequence of a suggested action. This has obviously led to a mainly neutral state. The most important result from both Tests is, however, that the simulation process has to far less an extent generated P scenes than A scenes and S scenes. Perhaps this result could be seen as an indication th (despite the popularity of the process models in the general debate) probabilistic models increase in complexity and that it is therefore much more difficult to apply the principles in solving a concrete task in an interaction process than is the case with the association and structure paradigms.

7.3 Analysis by means of regular Markov chains

If we regard the scene sequences generated by the simulation process as Markov chains, we can say that the simulation process is in different stat $(t_1, t_2, t_3, \ldots)$. The fact that the simulation process is in state k at time n can in accordance with Fisz (1971, pp. 296-301) be given as $t_k(n)$ and it probability we denote with

$P\left(t_k(n)\right) = \pi_k(n)$

The vector

$\pi(n) = \left[\pi_1(n), \pi_2(n), \pi_3(n), \ldots\right]$

then contains the probabilities that the simulation process will generate at random the different states (t_{10}, t_{nm}) at n point in time. Moreover since the simulation process must at a certain given point in time, be in a particular state and cannot be in more than one state, the probability vector $\pi(n)$ must add up to 1, i.e.

$$\sum_k \pi(n) = 1.$$

In our case the probability that the simulation process changes from state i to state j is unknown and must be estimated. It can be estimated on the basis of the transition matrices (Tab. 7 and 8), since

$\hat{P}_{ij} = \frac{y(n)_{ij}}{y(n)_i}$, where

$y(n)_{ij}$ denotes the number of transitions from state i to state j and

$y(n)_i$ denotes the number of times the simulation process is in state i (see Kemeny & Snell, 1960, p. 145).

If the simulation process can in N steps reach any state irrespective of the starting point, the generated scenes can be looked upon as regular Markov chains. Since CIR acts equifinally (see Chap. 5. 3), this assumption can be taken as being confirmed. A regular Markov chain also presupposes that there is no "transient state". Since the simulation process must lead to a final state (see Fig. 2), this requirement is also fulfilled.

If the idea of Markov chains is now applied to the transition matrix that has been constructed on the basis of the scene sequences from the first Test (Tab. 7), it become possible to construct a matrix that contains transition probabilities. The matrix is presented in Table 9.

Table 9. Transition probabilities for observed transitions from Test 1

State i	j	0	1	2	3
0		.00	.60	.40	.00
1		.31	.56	.06	.06
2		.00	.35	.41	.24
3		.18	.09	.18	.55

i = states preceding in time
j = states following in time

Starting from the proportions presented in Table 9, the following two questions will be studied:

1. To what extent is the simulation process influenced by the information carrying sign-systems built into the scenes?
2. To what extent will future simulation processes generate proportional distributions corresponding to those presented in Table 9?

As can be seen from Table 9, the simulation process has in 56 % of the cases generated A scenes. Only in 6 % of the cases does an A scene follow an S scene or a P scene. In 31 % of the cases, however, an E scene follows an A scene and so on.

Before question 2 is answered, it will be re-formulated into the following hypotheses:

H_0: The simulation process generated scene sequences with the same proportional distribution of A, S, P and E scenes.

H_1: The simulation process generated scene sequences with differing proportional distributions of A, S, P and E scenes.

The hypotheses have been formulated from the assumption that possible changes in the proportional distributions from one experiment to another or from one term to another depend solely on the process that is described by means of a transition matrix. (Before continuing this line of argument, it should be mentioned that owing to the low n-number of measuring objects, such an analysis of Tab. 7 and 8 will only give examples of how future experiments could be evaluated.) With a suitable number of n-number measurin objects, this type of analysis can be carried out, since the simulation proces is equifinal, i.e. there is a final result irrespective of where the process has been started. By analyzing separate scene sequences, it is naturally also possible to study individual processes. The assumption on which this analysis is based is that the Ss's decision after seeing a particular scene is only influenced by the decision made after the immediately preceding scene. More concretely, the assumption means that the decisions made by the Ss after the initial scene has been shown do not influence our prediction of the final result.

When the Ss know neither which scenes belong to which paradigms nor with what probability a certain scene follows a suggested action, uncertainty exists. Moreover there is a priori no reason to believe that any one paradigm would have greater steering effects on the simulation process than any other. A good starting point for testing H_0 could be to assume the same probability

(p) for the different states of the simulation process. This means that each branch in Figure 2 can be allotted an a priori probability of p = .25. In this way we get an asymptotic vector a, i.e.

$a = (a_1 = a_2 = a_3 = a_4)$.

The vector determines to what extent the simulation process is in different states irrespective of the paradigm. Since the vector limits the course of the simulation process, it will be called the limitation vector.

If the paradigm has not been of any importance for the simulation process, there should after a trial run exist approximately the same proportional distribution as stated in the limitation vector. If the matrix in Table 9 is pre-multiplied with vector A = (.25, ..., .25), we get as a result a new vector a' . This shows the following a posteriori distribution

a' = (.12, .40, .26, .21).

The trial run during Test 1 shows that the paradigm has influenced the simulation process. In 40 % of the cases the simulation process generates A scenes. Compared to the others, this is a very pronounced result. In the context of this result and all other reservations we can for the time being formulate the following conclusion: The Ss's suggestions for action generate sequences of events whose affordance-structure mostly refer to the characteristics of the association paradigm.

The basic theorem for regular Markov chains (see Kemeny & Snell, 1969, p. 69) says that this result is independent of the present state of the Ss, i.e. that it could be possible to generalize the results for future situations. This would mean for the interpretation of a' that successive trial runs increasingly resemble the initial vector's distribution of the proportions. Thus the process should be independent of a certain given initial distribution and should maintain an equilibrium. The transition probabilities are shown in Table 10.

Table 10. Transition probabilities for observed transitions from Test 2

State i	j	0	1	2	3
0		.53	.20	.20	.08
1		.30	.35	.22	.13
2		.28	.22	.39	.11
3		.44	.11	.11	.33

i = states preceding in time
j = states following in time

If the matrix in Table 10 is pre-multiplied with the vector a' = (.25, ..., .25) we get as a result an a' vector that shows the following a posteriori distribution

a' = (.39, .22, .23, .16).

The trial run during Test 2 shows that the paradigm has influenced the process. In 39 % of the cases the simulation process generates E scenes, which should constitute a clear result of the partly different goals described in Chapter 6. 3. In addition there is further accentuation of the low proportion of P scenes, while the proportion of A and S scenes is almost as large. Despite a clearly more even distribution of A and S scenes, the simulation process has led both to a powerful increase in the proportion of E scenes and a further reduction in the number of P scenes. But even though a larger random sample of measuring objects and a more uniform execution of the different experiments would be required before more far-reaching conclusions could be drawn, the following conclusion can be formulated:

Tests 1 and 2 seem to indicate that SIR functions as a very sensitive instrument for simulation of interactive behavioural strategies. Moreover, the simulation process suggests that future experiments can lead to acceptance of H_1, which could result in important psycho-ecological insights.

8. Continued research and development work

People observe, evaluate and integrate information about themselves and their environment differently during different phases of development. We know, for example, that people have different cognitive models, which means among other things that social rules and conventions are interpreted differently. Thus a person's behaviour is assumed to be a function of his cognitive models, the purpose of which is to provide him with a system of rules for interpreting and using available information.

Each meaningful behaviour is based on knowledge and evaluations. The ability to structure a situation and receive ecological information presupposes a certain cognitive development. If there proves to be a gap between knowledge and the behaviour required by a particular situation, a person reacts affectively and there is no consideration of possible alternative behaviours. The ability to function pro-socially and cooperatively requires a behavioural training for which we have hitherto lacked well-established knowledge and suitable instruments. Thus it is a highly important research task to study on which theories the behaviour interpretations of individual people are based.

The present report shows that with SIR we have succeeded in creating an objective and reliable system for a study of and training in the construction of interactive behaviour strategies. By means of SIR we can study the relations that are assumed to exist between ecological information and different cognitive models and how far these are based on fundamental principles of behavioural science. Thus SIR can be used to study the causal structure behind different sequences of events, i.e. the regularity of the dependence between different events. Development implies namely progression through a number of successive phases. That which exists in one phase is transformed to something that is related to what existed previously but is in some respects also separated from it.

The next step in this research and development work should be the development of an objective and reliable instrument that can steer the EL choice of the scene that forms the most probable consequence of a suggested

action. Providing that the same arguments concerning the theory of probability (see Chap. 7) also apply to the S's suggestions for action, we can say that: The sign-systems built into SIR influence the S so that she, after having been shown scene 1 (S_1) with probability q_1, chooses to suggest action H_1 with probability p_1. After S_2 has been shown with q_2, she chooses H_2 with p_2 and so on.

In order to be able to quantify and measure to what extent a suggestion for action (H_i) covariates with the scene (S_j) that EL shows, the S should be asked to estimate to what extent an event agrees with her "hypothesis", i.e. to what extent the affordance-structure of the event covariates with her implicit cognitive model of an expected consequence.

The congruence could be estimated. S marks on a ten-point scale for each scene shown how far it is congruent with the suggested action. The poles of the scale could be: 9 = exactly as expected and 0 = not at all as expected. By means of a step-wise multiple regression analysis with suggested actions as predictors and each single scene as criterion, it would be possible to study the relations between a number of suggestions for action and a particular scene within a multi-variate context.

If this phase of the research process has led to an objective and reliable instrument for coding all the verbalised suggestions for action that Ss can be imagined to give in connection with a scene shown on the TV monitor, the final phase can be introduced by means of a validation experiment.

The validity could be studied by different groups of student teachers being given special training in the paradigms described. Provided that this training influences the student teacher's cognitive structure and thereby her suggestions for action, a study could be made of what effect a training in fundamental behavioural science principles has on the generation by the simulation process of sequences of events.

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10. Appendices

Box 1. Description of video recorded situations (scenes)

Order No	Scene No	Description
1	2	You turn towards Göran and say: "This is going to be your new classroom. I'm sure it's going to be lovely, aren't you Göran?" Göran glances at the aquarium through the half open door of the classroom but quickly turns back and looks at the floor when you begin to talk to him.
2	3	You say to Göran: "As you can see we've got an aquarium in the classroom; perhaps you've got one at home as well?" Göran answers: "Yes" in a quiet and shy manner and then turns round to his mother and buries his face. The mother holds on to him again.
3	5	Gently you ask Göran if he would like to come and look at the different fish in the aquarium. Göran reacts slightly, gets up and walks slowly over to the aquarium. He takes a quick look at the fish for a moment but then looks down at the floor again. When Göran goes back and sits down, he looks up momentarily at the aquarium once more, then fixes his eyes on the desk.
4	6	You say that you need someone who knows about fish to look after the aquarium and ask Göran if he would like to do that during the week. Göran lights up and answers yes, after which he, a little shyly, gets up and goes across to the aquarium of his own accord and looks at the fish. He then looks up at you.
5	8	You ask Göran whether he thinks that it is strange to come to a new class and whether it worries him. Göran remains pressed against his mother and looks at the floor. As soon as you have finished your question, the mother answers for Göran. She says that Göran is always so afraid when he's faced with something new that he is not familiar with and even more so when she is not at hand.
6	10	You ring up the school counsellor and ask her whether she has any information about Göran. The counsellor reads through Görans file and says that Göran is a boy of normal intelligence, who has been placed in a special class on social grounds. He has had a disturbed childhood due to an alcohol problem in the family, which meant that he lived in the country with his grandparents for three years. When he was about 5 years old, he moved back to his parents who were living in a slum area. The mother did not dare to let Göran go out because it was a rough neighbourhood. The family's social situation has now improved and they are now living in a newly built estate with lots of children. Göran has always been unconfident, and kept himself to himself. He finds it different to make friends both at home and at school. Göran doesn't dare go out alone. In the remedial class Göran was very timid at first, but after a while he adjusted better.

Box 1. (Cont.)

Order No	Scene No	Description
7	11	You make a visit to Göran's home and talk with the child's mother and father. The father sits in silence while the mother does all the talking. You learn that Göran lived with his maternal grandparents for 3 years when the famil had problems. Göran enjoyed playing with the animals. When Göran came back home the problem became worse, since the other children were so terrible that Göran could not go out by himself. When the family moved to a nicer area, Göran didn't dare and didn't want to go out without his mother. At home Göran and his mother get along fine, and both enjoy each others company. The mother says that it is a bit of a nuisance to have Göran hanging about all the time. She had to go to school with him and stay to the lessons for a whole term when he was in the former class. She hopes that things will be easier this time.
8	12	The class is busy drawing and you say "Wouldn't it be fun to see what your drawings look like?" The pupils have drawn fine, colourful pictures. Göran is sitting fiddling with his crayon after having drawn a very simple line-drawing, dominated by a large mother figure. A small father figure can be seen on one side and a small dark armless figure can be seen in one corner of the sheet.
9	13	You look at Göran's drawing of the family and say: "That's good Göran, can you tell me what the people are called?" Göran sits and twiddles the chalk in his hands and answers softly "Mummy, daddy", and then after a while he embarrasedly adds "and me".
10	14	You and four pupils are standing in front of the teacher's desk ready to omprovise a small play. You suggest that the two girls play mother and a daughter on their first day at school and that Göran and another boy should act as the "old hands" in the playground. To start with, Göran looks shyly down at the floor. The play begins. The new girl and her mother come and say hello to the boys. Göran says "Hello" quietly. The mother says that the daughter is new to the playground. The daughter clings to her mother and cries out in protest when the latter suggests that the girl should stay and play with the boys. Then, with sudden power in his voice, Göran says" Can't you do anything without your mum being there?" after which he and the other boy begin to nudge and tease the girl by saying "Mummy's little pet". The mother returns and scolds the boys whereupon Göran aggressively sweers and says: Shut your mouth, you old bag."
11	15	You ring the mother and tell her that Göran is getting alon better with his classmates. You ask how things are at home. The mother says that Göran had been out in the neighbourhood for the first time and that after a while he began to play with a much younger girl. She says that at first he was a little anxious but that everything had turned

Box 1. (Cont.)

Order No	Scene No	Description
12	18	You want the mother to leave the class. She is standing at the door with Göran by her side. You say: "As you can see, Mrs Larsson, I think its best if you leave the class-room". The mother refuses to leave Göran and becomes very agitated. She says that it is not allright at all, as Göran is so terribly shy and afraid when she is not with him.
13	20	The class is working away with some problem. You want Göran's mother to leave the classroom and say: "I hope Mrs Larsson understands what I mean?" You then tell the class that Göran's mother must go and ask them to say goodbye to her. Göran looks disconcertedly towards his mother and stands up, even though a little hesitantly, when the others do. He quietly says goodbye along with the others. When the mother goes out of the door, Göran looks as if he will run out after her, but he changes his mind and sits down along with the others.
14	21	You have given the class the task of making a collage about the different seasons of the year, saying "Now let's see if this group has found any pictures of summer. Göran's group is working hard cutting up newspapers, except for Göran who sits and fiddles with his scissors. The others in the group asks him to look for pictures but Göran sits there doing nothing. The one sitting next to Göran suggests that he looks for a sun and offers to help him. While the friend begins to look through their pile of papers Göran looks up and begins to flick through them carefully. Suddenly Göran finds the sun he has been looking for and his whole face lights up. He shouts out that he has found it.
15	23	Göran is standing in the room. He looks dejected and sad and is staring at the floor.
16	24	Göran is standing in the room. He is holding his face in his hands, sniffing and crying.
17	25	The mother and Göran are standing in front of an aquarium. The mother says: "Look how nice they are, dear" and hugs Göran, who doesn't react.
18	35	Göran is sitting at his desk doing sums in a book. You lean forward and look at Göran's work. You commend him: "My, those are fine figures there, Göran." Göran replies quietly. "I always do them like that." You talk a little longer with Göran, and ask him why he arranges his figures in a special way. He quietly explains why and then looks up at you.
19	36	You talk to Göran's former teacher on the plane. You ask for suggestions as to what to do with Göran. The former teacher says that Göran was very inhibited and unsure of himself and that the mother was present in the class the

Order No	Scene No	Description
		whole of the first term, which was a bit trying. She says that it is no wonder Göran behaves as he does when he has had a disturbed childhood and even now his family is not very sociable. Her advice to you is to do what you feel is best for Göran in your class. She also lets you know that Göran is intellectually normal.
20	37	You and Göran are sitting side by side talking to each other. You ask him: "What's it like being new in school?" He replies shyly "Don't know". You ask him if he's got to know anybody in the class. He gently answers "Stefan". You say that you've heard that he likes reading and ask him what he likes reading best. He says that he likes reading different kinds of things. You ask if he likes Asterix. His face lights up and he answers yes. You ask him which of the characters he likes best. Göran answers: "Obelix, because he's always fighting."
21	38	You are sitting round a table, talking with four pupils - Göran, another new boy and two "old hands". You try to get a conversation going and start talking to the new-comer and the boy at the same desk. They discover that they have a common interest in football and decide to train together. You then ask Stefan, who is sitting next to Göran, if he also likes football. Stefan shakes his head and says he prefer to read. You turn to Göran and wonder if he likes reading. Göran sits looking down at his hands and answers quietly: "Yes". They soon discovered that they both enjoy reading Asterix. Stefan offer to lend Göran his comics. Göran looks up, looking a little happier, and quietly says that he'd like to do that.
22	41	You suggest that the mother leaves the classroom and go and wait in the staffroom which is usually empty at that time. You follow the mother.
23	42	You ask the class: "What shall we show the newcomers?" Lots of suggestions are put forward. You then ask some pupils chosen in advance to show the newcomers around. Stefan goes up to Göran and suggests that he should go around with him. Göran sits at his desk and mumbles "I don't want to."
24	43	You talk to the mother saying: "I'm sure everything will turn out all right. Mrs. Larsson" and explain that all children feel uneasy in a new class. You finish by saying: "You slip off home now." Göran is sitting a little bit away and when his mother approaches the door he seems un-happy and disconcerted.
25	45	You introduce the new pupils in the class by name. The newcomers all look up when their names are called out, except Göran who shyly looks down at his desk.

Box 1. (Cont.)

Order No	Scene No	Description
26	47	You ask the class where Göran went off to in the break. Stefan answers: "He's probably gone home."
27	41	You suggest that all the pupils should introduce themselves by name. The pupils begin to introduce themselves. Göran sits and stares down at his desk.
28	53	Göran is sitting at his desk with his mother at his side. He is doing his sums and his mother looks at the book in an interested manner. You lean over Göran and praise him for his figures saying: "My, what fine number you're writing, Göran." He quietly replies: "I always do." You talk some more with him and ask him why he writes down his numbers in a special way. Göran quietly explains why as he turns towards his mother who is smiling at him.
29	55	Göran has been given a desk to sit at. You put your hand on his shoulder and go along with him to his allotted desk. You say: "You've got a nice place here next to the aquarium. You can see the fish clearly from here. Göran lets himself be led to his desk but he is stiff and tense. He slowly sits down and seems near to tears.
30	56	You go into the classroom and tell Göran that he's got a nice desk next to the aquarium from where he can clearly see the fish. The mother leads Göran to his desk. She draws up a chair and sits next to Göran. Göran glances at his mother and then looks down at his desk again.
31	57	You give the pupils the task of drawing something to do with summer. After thinking about the subject for a bit the pupils begin to draw enthusiastically. Göran looks uncertainly and shyly at his industrious neighbours. After a long hesitation Göran begins to fiddle with his crayon and then carefully draws a little boat in one corner of his paper. You commend Göran on his drawing.
32	58	You give the class the task of drawing something to do with summer. They begin to draw energetically after thinking for a while. Göran is sitting stiffly looking down at the blank sheet of paper in front of him on the desk. After a while he looks beseechingly at his mother and says quietly: "I can't think of anything what shall I draw?" She immediately replies: "Draw a boat, you're really good at that." Then the mother takes the crayon and draws the outline for Göran.
33	59	Göran is sitting at his desk with his mother standing beside him. You want the mother to leave Göran and say: "Goodbye then, Mrs. Larsson." Göran half gets up out of the chair, looking worried and desperate but then sits down again.

Box 1. (Cont.)

Order No	Scene No	Description
34	60	Göran is standing by his desk. He mumbles: "I don't want to."
35	61	You put your arm around Göran's shoulders and say: "I will all turn out all right, Göran." Göran stands still a stares down at the floor.
36	62	The class is talking and making a noise. You are stand in the door with Göran and his mother. You say to Göra that you've heard that he was very clever in his previou class and ask him: "You were the best at sums, weren' you?" Göran looks down at the floor but he nods weakly and then looks up. You then ask Göran if he likes drawi He nods weakly. Straight away his mother replies: "Ye you normally like that, don't you, Göran?" Göran turns away again and stares gloomily at the floor.
37	63	The class is chattering noisily. You, Göran and his mo are standing in the door. You ask Göran: "Which do you think is the best subject in school?" Göran looks down the floor, not saying a word. His mother answers inste "Göran's best at sums but he loves drawing, don't you Göran?" Göran stares down at the floor and shows no reaction to his mother's question.
38	64	You are standing talking to the mother, who has Göran her side. The pupils are quarrelling and making a noise A bored looking pupil say: "Aren't we going to start soo
39	65	You suggest that the newcomers to the class should go Stefan on a guided tour of the school. The newcomers g up and go over to the door where Göran and his mother standing. Stefan goes on ahead with the others and signa to Göran and his mother to come along. The mother tak Göran's arm and begins to follow the others. Göran qui follows after her.
40	69	It is the first day of term and you are on your way to th classroom. On approaching you see a new pupil and his mother sitting outside the door. The mother sits up whe she sees you coming and gets up quickly at the same tim putting the boy up from the chair. You say hello to the mother, who introduces herself as Mrs. Larsson, Göra mother. You turn towards Göran and say "Hello". Göra doesn't say anything but instead turns towards his mothe The mother says: "Göran is so terribly frightened, I do think he'll dare to stay in the class if I'm not there." Göran stares down at the floor.
41	70	You turn to Göran and try to encourage him by saying: "I'm sure everything will turn out all right. Everyone in the class is so nice and friendly." Göran looks at the flo while you are talking to him and edges nearer his mothe

Box 1. (Cont.)

Order No	Scene No	Description
42	71	You are standing in the doorway to the classroom and say: "Here's your new class; there are 3 other new pupils as well, and they think it's a little strange to come to a new class." Göran looks down and doesn't want to go into the room. The mother goes as far as the door. Göran hesitates a bit before joining her. Göran glances in at the classroom but returns his gaze to the floor. You put your hand on Göran's shoulder when you're stopped talking. Göran stiffens but doesn't pull himself away.
43	72	You show the classroom to Göran and his mother and suggest: "Göran, you and your mummy can sit together and see what the class does." Göran stands with his mother staring down at the floor. When you suggest they stay Göran moves towards the door tugging at his mother's coat trying to get her to go with him. Göran mumbles quietly: "I want to go home". The mother glances anxiously at you, shyly nods an embarrased farewell and follows Göran towards the door.
44	73	Göran and his mother stand outside the classroom door. You say to Göran: "Come in and meet your classmates." Göran doesn't react to the teacher's suggestion. He is holding his mother's hand and when she comes into the classroom he follows unwillingly. Göran quickly looks up but then goes back to looking at the floor.
45	74	You suggest to Göran that he sits with Stefan and 3 other pupils in a group of five desks. You go with him to the desks. He is quiet and shy and sits down hesitantly next to the boy at the desk and he looks worriedly down at the desk lid.
46	75	You suggest that Göran sits with Stefan and 3 other pupils in a wor of desks. The mother goes with Göran over to his desk. Hesitantly Göran sits down. His mother draws up a chair and sits down next to him.
47	76	You let the class play with dice. The pupils sit in groups of five. Stefan, who sits nearest Göran, asks him if he knows the rules and then suggests: "You throw first Göran." Göran looks quietly down at the desk playing with the dice in his hand. Stefan tells Göran to get on with the game. Göran clumsily throws the dice and turns to look at his mother, who smiles back at him.
48	77	The class has been given the task of making a collage about the different seasons of the year. You say: "Now let's see if this group has managed to find any pictures about summer." Göran's group is working hard at cutting up the papers, except for Göran who is sitting playing with his scissors. His group ask him to help them but Göran sits there doing nothing. The one next to Göran suggests that he looks for a sun and offers to help him.

Box 1. (Cont.)

Order No	Scene No	Description
		Göran turns doubtfully to his mother, who smiles at him. The other begins to flick through the papers as Göran look shyly to her side. A friend suddenly comes across a sun, which he shows Göran. Göran takes the scissors, although a bit unenthusiastically, and begins to cut the picture out.
49	78	The mother and Göran are standing in the doorway. You say: "No we're got to know one another a little better now," and then ask the "old hands" to show the newcomers around. Stefan who has been allotted to Göran, goes up to him and suggests that he comes along with him. "Come on" Stefan urges. Göran's reaction to this is to press closer to his mother, who puts her arm around him. When Stefan urges Göran to go along with him, Göran mutters quietly: "I don't want to."
50	79	You let the class play "A ship arrives loaded with ..." The pupils are sitting in a circle. Göran is sitting there crouched up with his mother behind him. The ball is thrown among the pupils and lands up in Göran's lap. He picks it up doubtfully. His classmates say: "A ship arrives loaded with ..." Göran says nothing and doesn't answer as he should according to the rules. He keeps the ball for a moment. The mother puts her hand on his shoulder and cuddles him. Göran hesitates a while but then gives the ball to the boy next to him without saying a word.
51	80	You let the class play "A ship arrives loaded with ...". The pupils are sitting in a circle. Göran is sitting there cronched up in his place. The ball is thrown among the pupils and lands up in Görans lap. He looks frightened but picks it up anyway. His classmates say: "A ship arrives loaded with ...". Göran says nothing and does not answer as he should according to the rules. He looks down at his knees and turns the ball round. He then looks up and gently tosses the ball to the boy next to him.
52	81	You have asked all the class to stand in the middle of the classroom. They are going to pretend in pairs to saw up something. All the pupils begin the exercise enthusiastically and happily. Göran is standing in the background with a classmate opposite him. He stares at the floor when the teacher talks to him. When the teacher has finished, Göran's classmate begins to pretend to saw. Göran looks shyly around him and then very cautiously begins to move his hands to and fro in a sawing movement.
53	82	You ask Göran how he's getting on in his new class. He mumbles back "Don't know". You ask in general what Göran has done during the summer and what he usually does in the afternoon and evenings. He answers reticently: "Don't know; watch TV." You ask if he has any friends. He quietly answers "No". You say that one of his classmates lives near Göran and suggest that they come to school together. Göran looks up at you.

Box 1. (Cont.)

Order No	Scene No	Description
54	83	You are sitting in a room with the mother trying to get a little more information about Göran. - Whether he's always so unsure of himself, how it was in his former class, whether he's got any friends. The mother says that Göran is always scared and worried when faced with something new. She used to attend school with him in his former class and thought that by the end Göran was better and a little less anxious. He is all right at home when Göran and his mother are together. The mother says that he hasn't any friends and he refuses to go out alone - "he daren't".
55	84	You make written recommendation to the school psychologist: 1. The family is recommended to make a visit to P. B. U. for family theraphy. 2. Continue with attempts to have him in a normal class. 3. The mother ought to be with Göran in class in the introductory stage. 4. Increased contact with a specialist teacher is recommended. 5. Specialist teaching ought to take place both in the clinic and the classroom. It is recommended that one should try and get Göran to express himself more through drawing or role-playing so that he can gain a greater understanding of himself. In the clinic, conversations which encourage him to make contact with others should take place.

Table 1. Product-moment correlations of 20 statements

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
1	43																			
2	12	58																		
3	45	14	53																	
4	46	12	50	50																
5	30	05	47	37	30															
6	37	04	18	30	02	60														
7	05	52	04	10	07	-03	46													
8	12	17	07	22	02	08	08	21												
9	09	38	12	14	07	03	29	33	30											
10	16	54	15	18	04	26	51	19	40	51										
11	15	70	14	14	11	10	48	19	39	55	56									
12	42	09	52	59	34	21	08	22	18	13	13	46								
13	11	54	12	10	08	03	50	11	34	49	52	06	42							
14	50	07	32	38	11	67	-02	01	05	21	12	28	05	62						
15	27	22	35	35	18	29	21	16	14	30	21	33	19	27	30					
16	42	13	34	35	17	55	08	-02	08	27	14	28	16	56	30	54				
17	39	06	20	30	10	67	03	01	02	21	09	21	06	63	26	64	62			
18	43	15	60	51	45	12	08	06	08	12	16	49	13	26	33	21	18	49		
19	52	09	36	41	20	58	06	-00	02	21	12	27	12	68	26	63	68	29	63	
20	03	37	-01	14	01	04	50	21	30	44	35	07	38	00	28	09	06	04	04	36

Table 2. Product-moment correlations of 19 statements

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
1	43																		
2	12	58																	
3	44	14	51																
4	45	12	48	47															
5	29	05	45	33	29														
6	37	03	18	30	01	59													
7	05	52	05	10	08	-04	46												
8	09	38	09	11	04	03	30	26											
9	17	54	15	18	03	26	51	39	51										
10	15	70	14	10	09	09	47	40	55	56									
11	40	08	52	58	33	21	08	17	13	12	45								
12	11	54	12	10	08	02	49	35	49	52	06	42							
13	50	07	31	38	10	67	-03	03	20	12	27	05	62						
14	27	22	35	35	19	28	20	13	31	21	33	18	27	29					
15	42	13	33	33	15	55	08	06	27	13	27	16	57	30	53				
16	39	05	18	29	07	67	03	00	21	08	20	06	63	26	64	62			
17	42	15	59	49	45	11	08	07	11	16	48	13	25	33	20	16	47		

Table 3. Factor analysis of 19 statements with non dichotomized and dichotomized scales together with the deletion of outliers

		Factor (non dichotomized scales) (55 scenes)			Rotated				Factor (non dichotomized scales) (54 scenes)			Rotated			
		1	2	3	I	II	III	com	1	2	3	I	II	III	com
Content	No				P	A	S					P	A	S	
Structuring of environment	17	62	-34	-43	82	-03	09	69	63	-34	-43	83	-03	08	69
The group's demand for adaptation	6	58	-32	-43	79	-04	06	63	59	-33	-42	79	-03	06	63
Own actions are made conscious	14	66	-37	-30	78	-01	23	66	67	-37	-29	79	-01	22	67
Consideration of each other's experiences	19	69	-35	-26	77	-04	27	67	71	-34	-25	78	-05	27	68
Creation of greater interaction	16	65	-24	-27	71	-12	21	56	66	-23	-26	71	-12	21	56
Creation of opportunities for structurization	3	59	-17	47	19	-07	74	59	58	-15	48	18	-06	75	59
Creation of "Aha" experiences	18	54	-12	51	11	-08	74	57	53	-10	53	09	-08	74	57
Confrontation to achieve change	12	55	-13	42	18	-09	67	49	53	-12	42	17	-07	66	47
Correction of earlier established structures	4	64	-16	33	30	-12	66	53	61	-14	32	30	-10	64	50
Concentration on the whole	5	36	-09	43	02	-03	56	32	34	-07	44	00	-33	56	31
Sensitivity to others' viewpoints	1	62	-23	11	45	-07	50	45	62	-22	12	45	07	49	45
Concentration on the present	15	51	06	09	26	-28	35	27	50	06	10	26	-27	36	27
Reinforcement of positive behaviours	2	42	65	-05	04	-77	07	60	41	66	-05	03	-77	08	60
Repetition of successful behaviours	11	45	60	-05	08	-75	10	57	44	61	-06	07	-75	10	57
Encouragement of desired behaviours	10	52	52	-20	24	-72	04	58	51	53	-20	07	-74	10	58
Search for reinforcement (interests)	7	32	61	-05	-02	-69	01	48	32	62	-04	-03	-70	04	49
Utilization of existing habits	13	38	56	-07	-05	-67	05	46	37	57	-06	04	-68	07	47
Distraction of attention from negative experiences	20	29	50	-08	03	-58	00	34	28	49	-07	02	-57	02	32
Systematic influence (successive approximation)	9	30	42	-04	-01	-50	12	27	27	43	01	24	-72	05	26
Extinction of conditioning	8	20	20	10	-01	-25	15	09							
	λ	5.29	2.90	1.63					5.16	2.88	1.63				
	%	26	41	49					27	42	51				

		Factor (dichotomized scales) (54 scenes)			Rotated				Factor (dichotomized, without outliers) (54 scenes)			Rotated				A priori hypothesis
		1	2	3	I	II	III	com	1	2	3	I	II	III	com	
Content	No				P	A	S					P	A	S		
Structuring of environment	17	60	-33	-41	80	-05	05	64	55	28	-45	76	-00	-00	58	P
The group's demand for adaptation	6	55	-30	-32	72	-05	05	53	59	-24	-25	66	-05	17	46	P
Own actions are made conscious	14	62	-34	-28	74	-04	17	57	52	-21	-39	68	-05	01	47	P
Consideration of each other's experiences	19	66	-36	-23	75	-03	24	62	66	-35	-26	76	02	22	63	P
Creation of greater interaction	16	62	-24	-22	66	-12	20	49	62	-17	-21	63	-12	21	46	P
Creation of opportunities for structurization	3	52	-16	48	16	-06	70	52	49	-17	48	13	-05	69	50	S
Creation of "Aha" experiences	18	42	-14	50	07	-03	66	44	41	-19	47	08	00	64	63	S
Confrontation to achieve change	12	48	-12	42	15	-09	63	42	39	-12	48	04	-05	63	40	S
Correction of earlier established structures	4	57	-14	28	30	-12	57	43	54	-20	30	28	-05	58	42	P
Concentration on the whole	5	31	-08	45	00	-03	55	30	31	-10	35	05	-04	47	22	S
Sensitivity to others' viewpoints	1	53	-23	08	43	05	40	34	40	06	04	24	-23	24	17	S
Concentration on the present	15	51	04	14	26	-27	38	28	58	-21	07	45	07	41	38	P
Reinforcement of positive behaviours	2	40	60	-04	03	-72	06	52	39	61	00	05	-72	06	52	A
Repetition of successful behaviours	11	42	56	-04	05	-70	08	49	42	63	01	08	-75	06	57	A
Encouragement of desired behaviours	10	54	47	-13	05	-70	08	53	45	48	-08	20	-64	06	45	A
Search for reinforcement (interests)	7	52	-16	48	01	-68	01	45	21	33	09	-02	-39	10	16	A
Utilization of existing habits	13	39	50	-05	07	-62	07	40	23	56	07	00	-61	07	37	A
Distraction of attention from negative experiences	20	32	47	-06	04	-57	03	32	31	57	-00	02	-65	02	42	A
Systematic influence (successive approximation)	9	25	38	04	-02	-45	09	21	22	41	00	01	-47	02	22	A
	λ	4.56	2.49	1.48					3.93	2.43	1.45					
	%	24	37	45					21	34	41					

Estimation of reliability: Association paradigm

Table 4. Product-moment correlations of 21 panel assessors: Association paradigm, A = Σ (2,7,10,11,13,20) and 54 situations

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
1	84																				
2	60	81																			
3	36	44	72																		
4	66	69	36	80																	
5	58	52	58	57	73																
6	68	49	31	43	43	81															
7	53	46	42	52	55	39	71														
8	73	72	35	72	59	43	62	89													
9	59	54	49	56	54	44	56	65	72												
10	65	71	36	67	59	46	45	73	56	83											
11	34	46	44	44	46	52	39	35	39	46	58										
12	51	44	16	60	45	40	34	68	47	54	33	62									
13	54	39	23	59	43	37	43	52	40	55	36	42	68								
14	68	74	40	61	57	56	64	61	57	69	48	36	42	83							
15	62	57	30	63	47	26	51	71	64	63	30	45	52	60	69						
16	72	64	58	63	63	78	54	63	63	63	58	43	48	73	50	87					
17	65	70	27	63	58	46	56	81	71	78	28	62	47	66	67	57	85				
18	58	52	16	42	65	44	45	63	37	64	41	51	43	54	42	46	64	74			
19	70	59	46	77	60	43	58	68	63	70	43	54	48	67	56	67	63	47	82		
20	67	58	20	52	44	57	46	60	49	62	33	42	23	54	48	60	59	47	46	71	
21	77	73	55	70	64	62	62	80	74	80	51	57	62	75	64	81	75	59	79	62	91

Table 5. Component and factor analysis: A = Σ (2,7,10,11,13,20)

Assessor	Component analysis Component	Factor analysis Factor		
	1	1	I	com
1	-24	83	83	69
2	-23	79	79	62
3	-15	50	50	25
4	-23	80	80	64
5	-21	73	73	53
6	-19	64	64	41
7	-20	67	67	46
8	-25	86	86	75
9	-22	74	74	55
10	-24	84	84	70
11	-16	55	55	30
12	-19	63	63	39
13	-18	60	60	36
14	-24	81	81	65
15	-22	72	72	51
16	-24	83	83	69
17	-24	83	83	69
18	-20	66	66	44
19	-24	81	81	66
20	-20	68	68	46
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

Estimation of reliability: Structure paradigm

Table 6. Product-moment correlations of 21 panel assessors: Structure paradigm, $S = \Sigma\ (3, 4, 5, 12, 18)$ and 54 situations

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
1	78																				
2	54	72																			
3	08	37	44																		
4	58	56	12	86																	
5	31	25	08	30	48																
6	42	44	08	56	42	79															
7	44	22	-05	52	23	11	58														
8	63	48	11	68	39	40	46	86													
9	49	29	-05	50	37	34	42	61	73												
10	58	41	15	46	33	33	34	50	71	80											
11	07	23	10	15	08	37	-07	-05	17	15	61										
12	05	29	-00	42	19	33	23	24	38	33	10	54									
13	57	30	02	66	31	45	46	82	46	30	05	16	86								
14	09	29	31	25	11	25	-09	14	11	08	26	27	10	48							
15	38	53	05	46	18	45	16	52	21	26	19	12	54	16	69						
16	61	51	08	67	44	69	20	60	53	52	31	21	47	32	33	86					
17	60	37	06	67	26	38	39	72	32	25	-13	08	75	12	53	40	79				
18	41	16	08	56	26	52	24	60	20	17	-02	13	72	07	34	41	60	73			
19	16	19	15	54	11	45	13	24	23	41	-03	38	15	21	04	35	35	32	84		
20	36	39	-09	39	53	59	04	40	29	21	12	14	34	16	33	57	34	29	20	58	
21	35	33	20	54	27	59	27	40	21	21	29	23	54	36	44	29	57	56	55	29	86

Table 7. Component and factor analysis: $S = \Sigma\ (3, 4, 5, 12, 18)$

Assessor	Component analysis Component 1	2	3	4	5	6	Factor analysis Factor 1	2	3	4	Rotated I	II	III	IV	com
1	-26	15	12	13	24	09	71	-16	21	-14	52	26	51	-05	60
2	-22	-20	04	09	40	06	60	23	06	-17	27	50	32	14	44
3	-06	-26	-15	-21	52	41	14	20	-11	-05	02	17	-01	21	07
4	-31	02	-01	-18	-01	-07	86	00	-02	-19	58	25	46	41	78
5	-18	-05	15	26	-20	35	47	09	12	-16	24	34	31	02	27
6	-26	-24	-12	14	-27	-03	71	37	-22	-15	37	65	15	35	71
7	-17	31	22	-23	08	-21	45	-31	24	22	39	-18	48	07	41
8	-30	23	04	-02	12	06	84	-32	13	-05	72	16	53	01	82
9	-23	04	45	-03	-03	-12	62	03	53	09	19	16	78	08	68
10	-22	-05	45	-12	12	07	60	17	53	17	09	19	78	20	69
11	-07	-42	01	22	07	-54	19	44	-04	-22	-10	50	02	11	28
12	-14	-21	23	-36	-22	-23	36	27	13	29	01	13	34	41	30
13	-28	27	-17	04	02	-16	79	-44	-15	-08	87	12	26	02	84
14	-11	-41	-15	-13	14	01	28	39	-18	00	03	39	-01	33	26
15	-21	03	-22	22	22	-30	57	-07	-17	-26	52	38	10	00	42
16	-27	-16	14	21	-06	12	76	26	-15	-23	32	61	47	13	72
17	-26	27	-25	-06	06	07	74	-41	-24	05	84	04	19	15	77
18	-23	18	-33	-05	-19	05	63	-26	-35	05	72	11	04	22	59
19	-17	-17	-05	-49	-31	24	47	30	-17	62	16	02	22	80	72
20	-20	-11	-00	41	-30	26	53	16	-03	-31	31	53	19	01	41
21	-23	-12	-36	-20	-10	-15	65	12	-48	19	55	29	-03	56	71
λ	7.99	2.02	1.68	1.46	1.31	1.02	7.64	1.54	1.31	1.00					
%	38	48	56	63	69	74	36	44	50	55					

Estimation of reliability: Process paradigm

Table 8. Product-moment correlations of 21 panel assessors: Process paradigm, $P = \Sigma\ (6, 14, 16, 17, 19)$ and 54 situations

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
1	89																				
2	78	94																			
3	62	69	82																		
4	70	66	65	80																	
5	75	66	58	52	77																
6	79	84	61	76	69	92															
7	74	90	68	68	60	74	90														
8	88	74	67	73	71	76	69	97													
9	69	79	65	69	60	84	72	71	85												
10	78	80	62	67	59	74	71	83	74	91											
11	70	63	66	56	70	63	63	79	52	58	89										
12	82	75	70	67	68	81	62	86	71	74	65	93									
13	70	76	71	68	74	78	69	69	72	55	55	75	91								
14	72	83	59	74	57	83	69	76	78	75	57	75	71	86							
15	76	85	62	71	66	86	75	77	85	75	63	82	76	81	89						
16	81	71	65	74	58	79	69	82	76	72	62	77	67	72	71	83					
17	77	70	68	70	73	80	59	70	71	63	60	81	85	68	75	74	90				
18	85	72	69	67	72	75	72	86	71	70	80	73	68	67	73	80	73	90			
19	80	76	71	70	67	81	72	84	76	81	77	74	68	70	73	80	72	86	89		
20	78	72	60	75	50	79	67	80	72	74	57	80	60	78	77	81	68	78	77	87	
21	83	81	69	73	69	83	74	85	76	70	62	85	82	83	80	80	79	79	73	77	90

Table 9. Component and factor analysis: $P = \Sigma\ (6, 14, 16, 17, 19)$

Assessor	Component analysis Component 1	Factor analysis Factor 1	I	com
1	-23	90	90	81
2	-23	89	89	79
3	-20	76	76	58
4	-21	80	80	65
5	-20	76	76	57
6	-23	91	91	83
7	-21	82	82	67
8	-23	91	91	83
9	-22	85	85	72
10	-21	83	83	69
11	-19	75	75	56
12	-23	88	88	78
13	-21	83	83	68
14	-22	85	85	73
15	-23	89	89	79
16	-22	87	87	75
17	-22	84	84	71
18	-23	88	88	77
19	-23	89	89	79
20	-22	85	85	72
21	-23	91	91	83
λ	15.51	15.24		
%	[illegible]	[illegible]		

Table 1. Product-moment correlations of 54 scenes

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
1	59																								
2	38	58																							
3	42	53	59																						
4	29	52	52	61																					
5	18	14	04	09	53																				
6	10	12	-03	03	40	63																			
7	13	16	-00	05	41	60	66																		
8	08	17	10	09	37	33	43	51																	
9	13	18	14	32	32	21	23	43	54																
10	-03	-02	-15	-13	26	24	27	23	19	52															
11	11	14	-00	16	36	57	56	40	32	34	59														
12	17	06	09	09	29	25	15	22	20	22	23	53													
13	13	03	12	11	14	18	11	20	04	21	16	48	50												
14	-05	05	-05	-02	-04	03	03	10	03	33	20	-02	17	64											
15	26	08	16	07	-00	17	07	15	08	-04	09	20	21	06	55										
16	26	18	16	10	10	16	08	10	00	-01	13	04	15	01	62	53									
17	48	47	56	41	07	-00	03	13	17	-07	05	07	08	-00	26	29	60								
18	29	41	44	44	04	-06	00	13	39	-11	03	-00	-03	-01	07	07	36	71							
19	08	19	05	16	45	60	60	48	33	10	54	18	11	-06	14	14	07	02	63						
20	26	50	43	51	17	13	16	20	39	-11	23	-02	-03	-04	08	13	34	49	28	60					
21	07	24	09	24	05	14	17	14	12	32	25	-09	07	51	01	00	14	09	10	27	60				
22	39	27	36	26	21	20	15	29	16	03	17	37	27	04	11	02	31	17	14	24	14	56			
23	08	11	03	-04	13	23	21	24	04	41	25	05	29	55	10	09	06	-07	08	00	55	18	69		
24	36	17	24	21	26	26	20	21	17	10	30	44	34	10	26	13	22	05	19	14	11	50	21	56	
25	24	19	06	-04	19	27	28	22	08	22	25	03	17	20	21	17	21	05	17	05	31	19	50	25	55
26	02	02	-04	08	23	31	20	31	16	15	25	26	23	16	12	06	-01	-05	36	06	11	19	17	23	09
27	19	18	17	05	16	18	23	26	12	19	22	09	17	25	21	08	15	10	18	07	29	18	43	22	48
28	24	34	37	45	11	-04	00	05	30	-09	07	01	-02	02	02	02	31	74	01	43	06	20	-11	14	03
29	37	41	57	44	-02	-00	-06	04	11	-18	-01	02	12	-07	16	57	57	40	06	30	12	31	04	20	12
30	33	47	50	51	02	-06	02	07	21	-14	05	-02	04	02	16	19	60	42	07	41	22	29	04	19	16
31	20	30	34	41	-06	-07	-11	07	36	-13	-00	01	00	09	14	10	31	49	-00	40	13	18	-03	09	02
32	30	37	41	53	05	01	-06	00	17	-16	07	02	06	00	04	12	39	45	05	45	17	27	-07	08	02
33	16	03	07	14	23	19	15	15	13	08	20	49	52	12	14	06	02	-05	11	01	-00	42	17	50	12
34	48	14	25	14	30	18	15	10	14	10	18	25	14	02	26	20	32	09	16	18	09	29	17	35	26
35	49	33	36	21	26	01	09	07	13	06	07	03	01	02	09	18	39	17	07	23	14	28	11	29	20
36	31	55	45	56	-02	-04	02	03	28	-24	03	-10	-10	-07	03	06	43	60	10	60	20	16	-16	09	-03
37	36	54	48	42	12	07	13	05	18	-15	05	-06	-07	-06	10	14	47	37	17	50	21	16	-01	14	11
38	-00	-04	-04	-11	09	07	-00	11	02	21	11	10	18	26	18	02	-03	09	01	-05	17	08	28	10	17
39	13	11	05	-04	18	14	22	23	07	34	22	09	31	47	21	16	13	-01	15	04	45	17	64	27	46
40	22	07	05	08	24	11	06	00	12	06	14	13	05	01	10	07	09	06	08	07	07	04	10	20	25
41	55	30	37	28	17	08	13	-01	05	00	08	13	08	-03	16	17	44	17	10	14	03	18	08	32	21
42	37	23	28	13	18	09	14	10	10	02	16	12	15	09	25	22	33	10	09	10	12	22	29	38	45
43	41	21	25	20	16	11	08	10	12	07	16	14	23	13	27	16	33	16	10	13	19	25	26	24	38
44	37	30	26	19	24	26	24	29	18	19	24	29	40	19	28	24	29	12	22	20	26	46	45	49	44
45	09	12	05	-03	22	18	16	32	06	28	24	21	35	47	13	05	12	-00	11	01	38	30	55	28	37
46	14	19	22	18	12	18	14	25	08	17	15	08	19	27	17	15	27	11	15	10	35	29	37	22	26
47	11	15	11	09	07	15	14	18	-01	38	26	13	30	58	13	10	18	01	04	-01	48	23	58	27	33
48	02	06	-01	-03	04	15	08	14	-03	37	29	08	29	71	14	10	04	-04	00	-05	51	15	57	19	33
49	16	23	16	06	12	08	14	17	02	32	19	16	28	45	18	16	13	06	04	12	44	25	59	25	30
50	04	08	09	13	11	12	14	17	09	42	28	07	25	59	13	03	13	02	07	04	52	15	53	20	30
51	05	11	06	06	08	13	09	15	06	43	19	13	27	61	12	03	09	-06	00	-01	47	23	57	22	28
52	-02	01	-02	01	06	08	12	19	06	47	26	08	25	56	08	00	23	-10	05	-08	48	09	56	18	26
53	22	33	21	25	43	36	46	35	30	26	41	16	13	15	07	11	24	17	35	39	31	26	22	18	23
54	09	12	03	06	42	59	66	36	24	29	50	28	20	14	13	07	04	04	53	15	22	20	27	22	27

Table 1. (Cont.)

	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54
1																													
2																													
3																													
4																													
5																													
6																													
7																													
8																													
9																													
10																													
11																													
12																													
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14																													
15																													
16																													
17																													
18																													
19																													
20																													
21																													
22																													
23																													
24																													
25																													
26	35																												
27	16	42																											
28	-04	07	68																										
29	-05	18	40	63																									
30	-04	21	45	65	63																								
31	03	06	52	33	37	51																							
32	-00	03	49	38	48	47	57																						
33	22	21	07	09	02	08	04	56																					
34	-00	23	11	15	20	08	07	21	47																				
35	03	13	17	30	32	16	18	04	21	51																			
36	-03	00	55	44	49	49	51	-06	07	28	71																		
37	-04	07	37	41	41	37	42	-00	18	32	62	59																	
38	18	21	-12	-05	-05	-07	-08	10	12	03	-18	-12	34																
39	25	42	-07	06	09	-05	-08	19	21	18	-10	00	27	66															
40	03	19	04	02	09	-01	13	02	30	23	07	14	05	17	30														
41	-01	16	27	39	31	19	27	13	35	50	25	32	-05	11	21	57													
42	02	32	17	32	32	10	10	23	31	35	10	20	06	31	20	49	49												
43	04	27	16	28	25	17	14	22	41	18	16	25	06	30	23	33	36	44											
44	24	32	09	28	22	09	12	35	31	20	12	17	27	49	12	25	39	45	64										
45	28	29	-04	03	03	01	-03	26	10	17	-07	-03	36	08	10	01	20	23	49	64									
46	27	23	08	30	26	06	18	15	14	24	15	13	29	47	04	17	26	19	47	53	54								
47	17	30	05	09	12	10	13	26	15	14	-03	11	22	51	09	12	20	25	35	54	41	67							
48	22	-34	-04	-02	01	03	01	19	11	02	-13	-06	32	51	05	00	10	18	32	55	37	72	75						
49	13	29	03	03	09	07	07	26	19	17	00	11	25	61	16	12	25	24	46	58	39	58	52	62					
50	16	35	07	07	17	13	16	16	18	11	-04	01	36	52	10	10	19	25	31	48	42	61	67	49	72				
51	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]			

Estimation of reliability: Total set of scenes

Table 2. Product-moment correlations of 21 panel assessors: 54 scenes and 3 summation statements. $\Sigma = (A, S, P)$

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
1	78																				
2	66	70																			
3	48	53	48																		
4	64	64	43	67																	
5	61	51	49	43	59																
6	71	64	43	58	54	76															
7	67	59	48	55	45	54	58														
8	78	69	47	71	61	59	60	83													
9	52	56	39	54	45	54	47	62	56												
10	66	68	43	61	48	54	48	72	64	68											
11	52	50	51	41	61	54	43	55	37	44	55										
12	66	56	44	59	56	61	51	71	48	58	51	63									
13	63	55	44	64	62	59	55	67	52	48	43	57	69								
14	66	70	48	57	45	66	63	61	50	58	48	57	51	66							
15	67	67	44	62	54	57	57	71	56	61	47	62	65	63	67						
16	75	64	54	68	50	78	58	71	60	63	52	57	57	68	57	78					
17	71	63	43	67	56	60	56	75	56	62	38	64	70	59	69	62	72				
18	67	53	38	56	56	60	53	73	43	55	53	55	63	52	54	59	67	66			
19	70	60	55	68	54	63	60	69	54	68	56	64	53	63	58	68	64	62	71		
20	69	60	39	58	50	67	48	67	48	60	47	62	48	58	62	67	59	58	59	62	
21	68	68	52	64	53	68	53	73	61	63	49	59	66	68	64	67	70	65	69	59	72

Table 3. Factor analysis

Assessor	Factor 1	com
1	86	75
2	80	64
3	60	36
4	78	60
5	69	47
6	80	63
7	71	50
8	88	78
9	68	46
10	77	59
11	63	40
12	76	58
13	75	57
14	77	60
15	79	62
16	83	69
17	81	66
18	75	57
19	81	66
20	75	57
21	83	69
λ	12.38 59	

Estimation of reliability: Association paradigm

Table 4. Product-moment correlation of 21 panel assessors:
Association paradigm, $A = \Sigma\ (2, 3, 4, 18, 20, 28, 29, 30, 31, 32, 36, 37)$ and 19 statements

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
1	60																				
2	52	50																			
3	37	40	30																		
4	57	52	39	51																	
5	33	35	28	27	34																
6	56	48	33	51	33	55															
7	58	54	39	57	36	53	60														
8	43	46	30	37	42	47	44	52													
9	45	48	33	38	29	52	60	46	53												
10	53	51	36	46	44	43	54	43	45	55											
11	34	21	30	33	22	42	21	13	19	29	35										
12	46	39	21	47	41	44	43	46	38	35	31	45									
13	45	39	20	36	24	37	42	53	27	39	14	40	41								
14	59	48	34	48	30	48	53	39	55	50	33	33	31	50							
15	50	44	24	35	23	40	43	36	42	48	22	38	30	44	39						
16	56	49	44	52	36	48	55	40	44	47	31	38	33	47	32	48					
17	54	50	34	45	41	52	51	48	46	51	32	49	39	45	41	48	51				
18	36	25	21	27	27	47	31	46	29	34	28	37	40	27	18	35	33	43			
19	43	40	30	42	31	42	53	41	42	53	11	35	39	40	32	41	38	42	46		
20	38	28	15	29	19	29	20	16	17	26	27	25	17	25	21	27	20	13	19	20	
21	50	52	34	43	32	53	54	45	54	57	24	39	44	49	40	43	55	50	54	19	57

Table 5. Factor analysis

Assessor	Factor 1	com
1	60	58
2	50	48
3	30	25
4	51	46
5	34	26
6	55	52
7	60	57
8	52	42
9	53	44
10	55	51
11	35	17
12	45	38
13	41	31
14	50	46
15	39	33
16	48	46
17	51	50
18	43	27
19	46	39
20	20	13

Estimation of reliability: Structure paradigm

Table 6. Product-moment correlations of 21 panel assessors:
Structure paradigm, $S = \Sigma\,(5,6,7,8,9,11,19,53,54)$ and 19 statements

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
1	41																				
2	30	39																			
3	18	14	30																		
4	13	37	19	54																	
5	30	30	12	22	57																
6	39	38	18	28	26	48															
7	17	20	27	-10	-07	-01	25														
8	40	28	17	22	61	16	01	77													
9	09	27	25	54	25	21	04	31	56												
10	31	37	16	53	39	27	-09	40	32	49											
11	08	17	08	27	00	32	07	-03	20	22	30										
12	25	36	00	24	56	24	-05	53	19	43	10	46									
13	35	19	06	13	52	12	03	75	37	23	-04	35	66								
14	25	28	19	27	12	44	12	23	06	20	17	18	12	35							
15	22	29	23	38	34	24	04	48	28	45	31	29	31	24	48						
16	37	41	09	34	38	33	02	39	33	44	06	36	31	27	38	44					
17	45	23	24	32	49	26	-00	71	35	38	-02	35	61	18	46	35	68				
18	25	25	04	18	46	21	03	61	29	28	-00	36	58	18	36	41	49	46			
19	25	36	18	25	53	27	-03	39	26	40	-00	42	31	20	23	45	45	34	46		
20	24	23	09	25	36	40	08	21	11	31	16	31	13	33	23	28	19	22	28	31	
21	32	38	04	43	34	40	-03	39	56	41	17	32	43	28	22	44	54	39	45	23	62

Table 7. Factor analysis

Assessor	Factor 1	2	I	II	com
1	50	-01	41	-29	25
2	53	-27	29	-51	35
3	25	-16	12	-27	09
4	53	-40	22	-62	43
5	67	25	70	-16	51
6	49	-41	18	-61	41
7	04	-09	-02	-10	01
8	76	45	88	-04	78
9	52	-14	36	-40	29
10	63	-20	41	-51	43
11	19	-44	-09	-48	23
12	59	10	55	-24	36
13	64	49	80	06	64
14	38	-31	15	-47	24
15	57	-10	42	-40	34
16	63	-09	47	-42	40
17	73	28	76	-17	61
18	61	29	67	-09	45
19	60	04	52	-30	36
20	43	-22	23	-42	23
21	67	-10	51	-46	47
λ	6.35	1.54			
%	30	38			

Estimation of reliability: Process paradigm

Table 8. Product-moment correlations of 21 panel assessors:
Process paradigm, $P = \Sigma\,(10,14,21,23,38,39,45,46,47,48,49,50,51,52)$ and 19 statements

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
1	62																				
2	48	49																			
3	44	39	42																		
4	53	50	32	56																	
5	49	43	34	35	46																
6	51	46	31	51	35	49															
7	48	43	41	45	33	43	48														
8	60	41	33	53	49	41	43	61													
9	36	41	31	39	30	28	31	30	37												
10	47	46	25	34	43	36	38	46	44	46											
11	39	45	36	33	42	35	34	35	30	38	36										
12	48	37	37	46	45	42	39	57	35	49	34	49									
13	45	42	37	52	50	46	36	52	36	37	27	49	54								
14	49	45	34	49	36	51	58	37	30	37	37	44	35	59							
15	48	53	38	50	42	48	43	48	51	48	39	49	58	46	57						
16	62	44	40	56	26	53	47	46	26	37	29	35	30	58	36	60					
17	54	46	36	49	47	49	46	48	42	43	28	51	56	44	58	43	53				
18	46	30	26	44	42	34	37	60	23	39	26	38	37	28	41	35	45	44			
19	54	41	50	44	39	44	49	51	38	46	39	42	41	38	49	39	45	42	51		
20	51	44	40	48	29	43	33	43	33	33	29	33	30	49	41	43	36	35	43	45	
21	59	56	37	54	42	55	44	48	43	42	44	42	48	59	57	48	49	38	41	53	59

Table 9. Factor analysis

Assessor	Factor 1	com
1	62	59
2	49	46
3	42	31
4	56	51
5	46	37
6	49	45
7	48	41
8	61	51
9	37	29
10	46	39
11	36	28
12	49	43
13	54	43
14	59	46
15	57	53
16	60	43
17	53	50
18	44	33
19	51	45
20	45	37
21	59	55

Estimation of reliability: Placebo dimension 1

Table 10. Product-moment correlations of 21 panel assessors: Placebo dimension 1, E = Σ (1, 15, 16, 17, 25, 26, 27, 34, 35, 40, 41, 42, 43, 44) and 19 statements

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
1	46																				
2	25	36																			
3	25	40	35																		
4	49	25	22	47																	
5	11	25	21	23	32																
6	42	20	26	42	17	42															
7	36	21	15	35	22	22	33														
8	23	16	16	17	27	19	16	27													
9	10	07	14	25	10	20	26	09	20												
10	40	40	30	42	14	33	28	20	32	43											
11	32	29	22	33	02	40	31	02	16	29	44										
12	14	13	13	19	19	06	12	31	03	17	12	34									
13	26	33	08	39	42	25	32	30	19	41	06	14	56								
14	36	31	31	38	05	26	37	04	18	35	37	12	14	35							
15	28	20	28	33	09	27	22	26	19	26	33	24	21	27	28						
16	42	26	24	45	13	50	41	30	23	48	35	26	46	38	34	54					
17	46	20	16	42	-03	36	19	00	13	35	31	03	21	30	20	41	40				
18	23	24	15	26	33	25	20	23	18	28	13	41	49	07	24	32	22	44			
19	18	18	08	33	11	18	21	07	19	31	40	13	37	21	28	33	15	34	37		
20	34	09	15	13	04	24	13	11	-08	09	27	30	01	21	21	23	27	18	02	29	
21	26	40	46	35	15	33	20	14	17	35	36	17	20	29	34	33	14	24	32	18	39

Table 11. Factor analysis

Assessor	Factor 1	2	I	II	com
1	61	-20	62	19	41
2	50	05	38	32	25
3	44	-09	41	18	20
4	66	-06	58	32	44
5	32	44	01	55	30
6	58	-16	57	20	36
7	50	-00	41	28	25
8	34	32	10	46	22
9	32	04	24	22	11
10	63	01	52	37	40
11	53	-35	64	02	41
12	33	25	13	40	18
13	55	49	18	72	55
14	52	-29	59	06	35
15	50	-03	43	26	25
16	71	-01	59	40	51
17	49	-29	57	04	33
18	50	41	18	62	42
19	47	09	34	34	23
20	32	-18	37	03	14
21	55	-06	49	26	31
λ	5.41	1.19			
%	26	31			

Estimation of reliability: Placebo dimension 2

Table 12. Product-moment correlations of 21 panel assessors: Placebo dimension 2, factor V, Σ (12, 13, 22, 24, 33) and 19 statements

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
1	34																				
2	29	65																			
3	12	14	20																		
4	18	28	18	54																	
5	09	29	10	07	51																
6	-01	35	-05	-00	34	44															
7	-27	23	10	39	29	23	60														
8	33	26	13	16	40	17	38	55													
9	16	34	11	03	19	21	18	39	47												
10	28	49	18	-06	34	17	31	52	48	65											
11	16	18	-04	-11	01	30	03	05	27	23	27										
12	13	03	-01	30	28	16	34	09	02	17	07	49									
13	18	07	20	30	39	19	47	34	06	12	-05	44	52								
14	28	45	28	28	-05	-03	04	09	26	21	06	-07	-03	44							
15	26	44	10	24	43	08	43	26	04	17	-13	04	24	19	61						
16	46	47	19	32	30	21	46	54	42	54	10	24	28	24	35	69					
17	33	24	23	43	04	08	35	18	09	16	04	26	17	33	14	48	53				
18	11	21	11	25	12	28	24	11	-06	08	-08	33	39	04	28	25	31	51			
19	-03	18	-02	04	06	15	04	02	-02	03	-05	27	09	-06	03	17	-08	39	54		
20	-05	14	-09	08	26	17	26	18	19	10	-07	18	06	-08	25	07	04	15	43	45	
21	16	05	13	32	30	13	51	48	29	19	-05	14	45	-10	10	26	14	16	-04	17	54

Table 13. Factor analysis

Assessor	Factor 1	2	3	4	I	II	III	IV	com
1	44	23	20	-05	-24	-15	-46	-03	29
2	58	36	-02	41	-54	11	-48	34	64
3	25	12	23	-07	-06	-10	-34	-07	13
4	45	-17	50	-01	20	-28	-59	13	48
5	52	-16	-34	-07	-33	-45	01	31	41
6	35	-07	-34	21	-33	-12	05	40	29
7	67	-23	05	-20	-12	-61	-33	22	55
8	63	11	-21	-29	-48	-53	-18	02	54
9	43	38	-29	-09	-62	-16	-12	-03	43
10	59	40	-31	-03	-71	-20	-21	07	60
11	11	29	-22	06	-38	08	01	-02	15
12	39	-41	03	08	10	-35	-15	41	33
13	53	-42	06	-23	08	-63	-20	24	51
14	29	45	37	21	-22	23	-60	-07	46
15	51	-06	09	15	-15	-20	-36	32	29
16	76	20	06	02	-45	-31	-54	19	63
17	48	07	47	03	01	-15	-66	05	46
18	41	-39	16	32	15	-17	-30	55	44
19	18	-34	19	53	02	08	05	67	46
20	28	-29	-30	24	12	-16	11	51	31
21	49	-23	-08	-48	-11	-71	-08	-02	53
λ	4.69	1.71	1.38	1.15					

Estimation of reliability: Placebo dimension 1 and 2

Table 14. Product-moment correlations of 21 panel assessors: Placebo dimension $E_1+E_2 = \Sigma$ (1, 12, 13, 15, 16, 17, 22, 24, 25, 26, 27, 33, 34, 35, 40, 41, 42, 43, 44) and 19 statements

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
1	35																				
2	27	32																			
3	21	33	25																		
4	39	26	21	40																	
5	10	23	12	11	29																
6	28	24	19	33	20	31															
7	32	21	13	35	19	23	28														
8	28	19	15	16	33	17	22	32													
9	16	18	12	16	20	16	17	24	21												
10	36	43	26	27	25	26	27	34	40	43											
11	25	26	17	26	-01	38	27	02	12	24	37										
12	14	10	09	22	22	08	17	23	04	17	10	25									
13	24	24	12	34	38	21	33	33	19	30	01	26	44								
14	33	34	30	36	-00	20	29	06	18	30	31	07	08	33							
15	28	27	23	30	25	22	26	26	14	23	23	18	22	25	26						
16	45	33	22	40	23	38	39	41	34	51	26	25	40	32	34	53					
17	42	21	18	42	01	29	22	07	12	28	25	10	20	31	18	43	37				
18	19	22	13	24	18	24	19	18	10	20	05	37	46	06	26	30	25	37			
19	12	17	06	28	05	18	19	05	10	22	35	15	26	17	22	26	10	31	29		
20	19	11	07	11	19	20	16	15	08	10	16	26	05	12	23	18	18	18	11	18	
21	21	31	39	34	14	29	27	21	13	28	31	15	23	22	27	27	14	18	27	15	32

Table 15. Factor analysis

Assesor	Factor 1	2	1	II	com
1	56	-13	53	24	34
2	52	-08	46	26	28
3	39	-15	40	13	18
4	59	-15	56	25	38
5	35	41	02	55	30
6	50	-11	47	22	27
7	52	-01	42	31	27
8	44	34	13	54	31
9	36	08	24	28	14
10	61	02	47	40	38
11	43	-41	60	-06	36
12	35	27	11	43	20
13	53	41	16	65	45
14	47	-36	60	-00	35
15	50	03	38	33	25
16	73	06	54	49	53
17	49	-23	52	12	29
18	46	29	18	51	29
19	39	-06	34	19	16
20	30	05	21	22	09
21	50	-10	46	23	26
λ	4.96	1.09			
%	24	29			

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