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The importance of motivational factors for the acquisition and representation of knowledge

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SUMMARY

Motivational conditions have been thus far largely neglected by contemporary theoretical approaches in knowledge psychology. The present article attempts to demonstrate the necessity for the greater integration of both. Suggestions are made regarding the choice and conceptualization of relevant motivational factors. Two possible groups of factors can be distinguished: (1) motivational factors of personality, and (2) motivational effects of action. Available theoretical approaches (e.g., the "levels of processing" approach) and examples are used to clarify the potential effects of these factors on the acquisition and representation of knowledge. Finally, a review is made of empirical studies allowing confirmatory allegations about the posited relationships between motivational factors and processes related to knowledge. This review reveals substantial research deficits on this topic.

1. INTRODUCTION

The failure to link motivational and cognitive (or knowledge-related) psychological approaches has increasingly aroused the critical scrutiny of various authors (e.g., Dörner, 1976; Eckblad, 1981; Eigler, Macke, & Nenniger, 1982, 1983; Hesse, Spies, & Lüer, 1983; Kuhl, 1983a, 1986; Mandl & Spada, 1984; Niegemann & Treiber, 1982; Sorrentino & Higgins, 1986; Zacks, 1985). In dealing with the acquisition, storage, change, and application of knowledge, the modern psychology of knowledge (e.g., J. R. Anderson, 1983; Mandl & Spada, in press; Tergan, 1986) has paid little attention to motivational factors. One explanation for this might be that artificial intelligence (AI) has served as a major codeterminant of the psychology of knowledge, while at the same time, functioning as one of its sources. Some objectives of AI-research are the implementation of computers as tutoring and expert systems (Mandl & Hron, in press; Stevens, 1985). Prevailing theories on the representation of knowledge within memory, especially propositional network models (J. R. Anderson, 1983; Collins & Quillian, 1969; Quillian, 1968; Rumelhart & Norman, 1975) are largely shaped by these

objectives; i.e., the application of these theories provide the greatest possible economy and precision in storing knowledge in the computer (Tergan, 1986; Wender, Colonius, & Schulze, 1980). In some cases, one may even assume a direct relationship between the formulation of theories and the availability of appropriate programming languages (Johnson-Laird, Herrmann, & Chaffin, 1984). Using computer simulation as a method for testing theoretical models is typical for modern cognitive psychology. As sensible and as necessary as this may be, the obligatory utilization of computer simulation and the simultaneous neglect of empirical analyses emphasizes the one-sidedness of the psychology of knowledge. Transferring models of knowledge representation and acquisition to human thought is, thus, a controversial issue (e.g., Mandl, Friedrich, & Hron, in press; Weinert & Strube, 1986; Wender et al., 1980), and not all representatives of these models assume their transferability (e.g., J. R. Anderson, 1983). Technological research objectives, with respect to AI, have dominated knowledge psychology over a long period of time. Non-cognitive factors, which are irrelevant for constructing computerized expert systems or systems which understand language and read images, have barely been considered.

Criticism of the "psychological reality" of the previously developed models (e.g., Johnson-Laird et al., 1984), has been one reason leading to the consideration and development of more "psychological" theories of memory, which also correspond better with developmental psychological, physiological, and neuropsychological results. The theory of mental models, which assumes a holistic-analogous form of representing knowledge, and theoretical approaches positing a distributed (holographic), associative storage of information in memory (Eich, 1985; Hinton & J. A. Anderson, 1981; Murdock Jr., 1982; Strube, 1984) are some examples of more psychological models of memory. Whereas the metaphor of the computer has previously served as a model for human information processing, psychological and neuropsychological findings about human information processing (e.g., parallel processing, holographic storage) now determine the development of computerized intelligent systems (Knapp & J. A. Anderson, 1984; Kohonen, 1977; Weinert & Strube, 1986). Thus, one can detect a change, - at least with respect to the representation of knowledge - which may be termed a "psychological transition".

The demand by various authors (see above) to pay greater heed than before to motivational influences on the acquisition, storage, and application of knowledge has also contributed to the transition from a rational-cognitive oriented science of knowledge to a more psychologically-oriented approach. This demand has been placed especially by researchers in instruction and learning (Eigler et al., 1983; Nenniger, 1986; Niegemann & Treiber, 1982). Snow (1986) may be cited as an example with his outlook on educational psychology during the 90's:

As a rule, representatives of cognitive-psychological research on instruction have ignored motivational processes. However, the integration of cognitive and motivational aspects of learning and instruction can be expected in research of the next ten years. Attention, motivation, will,

endurance, and self-regulation are concepts applying to such an interactional approach; they are currently viewed as being basic to learning through instruction. New indications have been found that these motivational phenomena have fundamental relevance for learning and are strong influencers of information processing. (p. 778)

Thus, Snow explicitly requires placing greater emphasis on investigating the effects of motivational factors on information processing. The objective of the present article is to substantiate the meaning of this inquiry, to develop ideas for models on the relationship between motivational conditions and the acquisition and representation of knowledge, and to discuss relevant studies in this context.

2. THE NEED TO INCLUDE MOTIVATIONAL FACTORS IN THE INVESTIGATION OF KNOWLEDGE-RELATED PROCESSES

What new insight can be gained by including motivational factors within theories of knowledge acquisition and representation? The first issue in this respect involves the explanation of interindividual differences in the acquisition and representation of knowledge. Within knowledge psychology, assertions can be made about how knowledge is acquired (e.g., through elaborations¹), how new information is incorporated within old knowledge (e.g., additive vs. integrative), how complex structures are developing (e.g., by increasing the relationships between stored concepts), which criteria should be considered in evaluating various structures (e.g., the number of concepts included, the number and type of relations among them, and their consistency), and what differences may exist in representing knowledge with regard to its contents (e.g., propositional vs. situational representations; see van Dijk & Kintsch, 1983). However, the psychology of knowledge offers little indication about possible reasons for interindividual differences in the above-mentioned processes and characteristics, which may be expected, for example, among pupils of a particular classroom. Whenever the focus is on interindividual differences, preference is given to cognitive explanations, such as the influence of prior knowledge (e.g., the comparison of experts and novices; Chi, Glaser, & Rees, 1982) and different cognitive abilities (e.g., problem solving capacity; de Jong & Ferguson-Hessler, 1986). In contrast, affective and motivational factors of influence have been neglected.

A second unresolved problem involves finding the reasons motivating a person to take issue repeatedly with a topic over a longer period of time, thus building a complex structure of knowledge. In reference to the numerous studies on cognitive differences between novices and experts, one might also formulate the question: What compels a novice

¹Elaborations are cognitive "enrichments" of information, which is newly assimilated (e.g., by reading a text). Examples of such enrichments are visual images, paraphrases, inferences, and associations with available knowledge or personal experiences (cf. Mandl, Friedrich, & Hron, 1986).

to want to become an expert? This is not a trivial question, assuming that the goals and motivational factors which codetermine one's involvement with certain topics, also influence cognitive information processing. It is precisely the experts for whom one can surmise a high degree of interest or motivation stemming from the subject matter itself (see below). However, significant differences might also be discovered among various experts, with respect to their motivational orientation (e.g., instrumental motivation vs. topical interest) and the accompanying (qualitative) differences in knowledge.

Presumably, both problems presented above, are closely related, because motivational conditions of personality (a more precise definition of this term will be given in Section 3.2), which initiate and maintain the commitment to a specific topic may simultaneously be the cause for interindividual differences in the quality of resulting knowledge structures.

In addition to the two above-mentioned aspects, motivational factors (either in the form of personality-specific initiators of action or effects accompanying or following action) might prove to be integral to the acquisition and representation of knowledge. Individuals acquiring knowledge, usually do so with respect to certain goals (e.g., good grades at school) and/or are in differing motivational states (quantitative and qualitative) when confronted with or acquiring new information. Corresponding cognitive theories and computer-based simulation models used to test these theories should therefore incorporate motivational components. Whether this will involve fundamentally modifying or extending previous (cognitive) theories of the acquisition and storage of knowledge, has yet to be established.

The above argumentation does not demand that the psychology of knowledge should provide immediate answers to the issues in question. Instead, our reasoning intends to demonstrate that structures of knowledge and their corresponding features are not (only) significant per se (from an educational psychological viewpoint), but particularly in combination with personal or motivational conditions which influence their formation and change.

It is important to note that motivational psychology can also profit from the greater integration of both research domains. The application of well-reasoned (knowledge-)psychological criteria to the evaluation of learning outcomes might possibly lead to greater accuracy in the assessment of motivational effects on the learning process (cf. Section 4).

3. THE RELATIONSHIP OF MOTIVATIONAL FACTORS, OBJECT-RELATED ENGAGEMENTS, AND THE ACQUISITION AND REPRESENTATION OF KNOWLEDGE

3.1 A diagram of the assumed relations

How might the interaction of motivation and the acquisition and representation of knowledge be represented in order to clarify the above-mentioned problems? Figure 1 is a schematic diagram attempting to describe the presumed relationships of motivational factors and knowledge structures. Six central components can be distinguished in this respect: motivational factors of personality, object-related activities and cognitive processes of knowledge acquisition, specific

effects of these activities and processes, object-related knowledge structures, the application of knowledge, and cognitive performance. The diagram also serves as a heuristic framework for conducting investigations, whereby each of the relationships in the diagram can be analyzed separately. In addition, the diagram may be used to classify existing investigations (see Section 4).

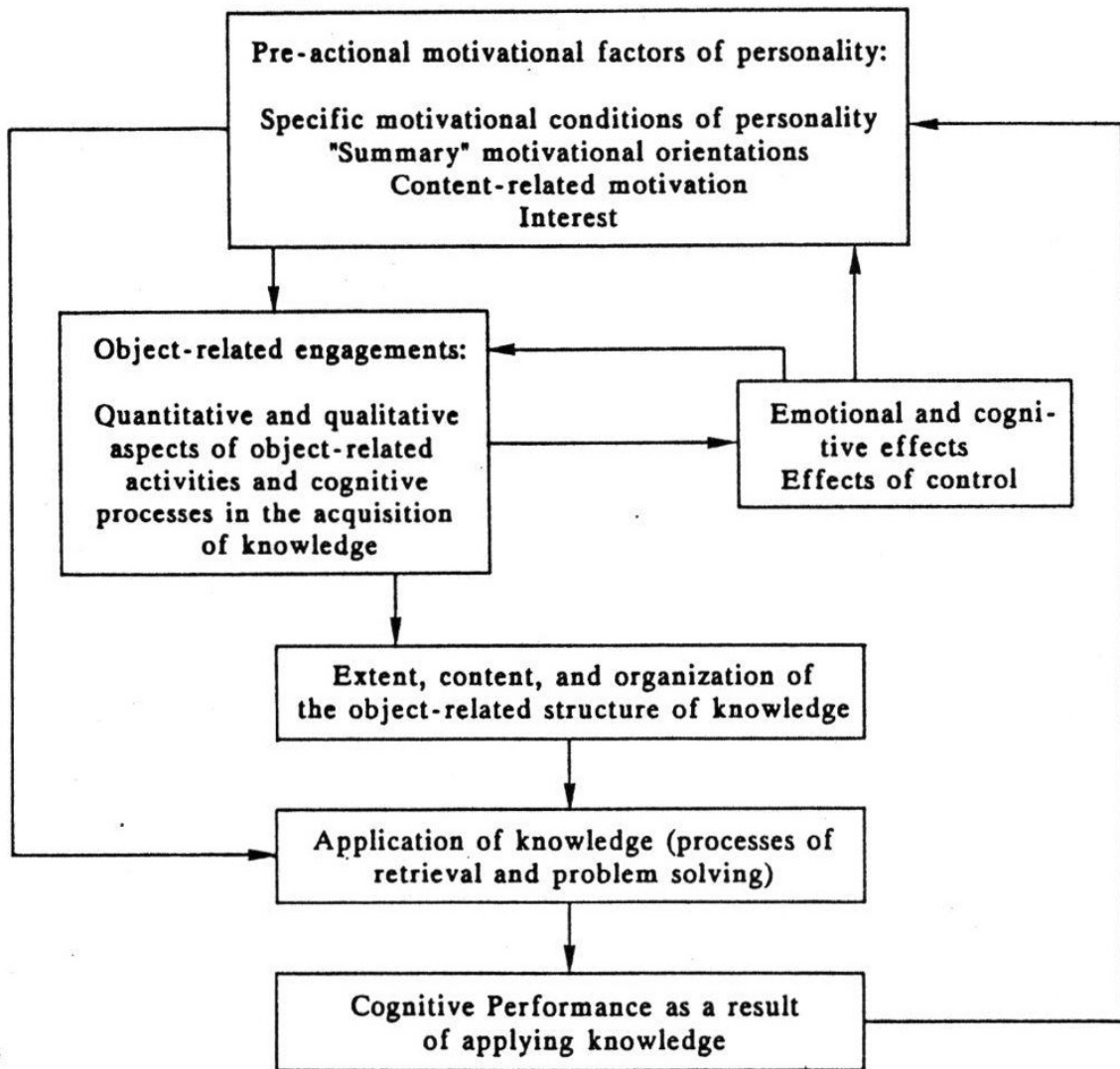


Figure 1. Schematic representation of the assumed relationships.

3.2 The differentiation of pre-actional motivational personality factors

The top box in Figure 1 contains possible pre-actional motivational personality factors. These may be divided into three groups: motivational conditions of personality, motivational orientations, and content-related motivation. Interest theories, which can be conceived of as motivational conceptions only in the broader sense are categorized separately.

The concept of motivational conditions of personality has been suggested by Pekrun (1986, following a critique of the motive concept) to describe persevering individual differences in motivation. Thus far, the concept of

motive has either been related to interindividually varying components of motivational processes (e.g., subjective valences of action outcomes; cf. Atkinson, 1964) or the entirety of motivational processes. An example for the latter is the achievement motive. This concept includes a variety of partial components with respect to motivational processes, e.g., expectancy and valence cognitions as well as subjective assumptions about behavior outcomes, social reactions to behavior outcomes, and resulting emotions. Because of this "overload" of the motive concept, Heckhausen (1977a, 1977b, 1980) has suggested dissolving the "summary" (in Heckhausen's words) motive concept, and instead assigning the interindividual differences within partial components of the motivational process to one (motivational) personality trait each. According to Pekrun, the following partial aspects of motivational processes can be distinguished (see also Heckhausen, 1985; Kuhl, 1983b): formation of wishes (selection phase), transformation of selected wishes into intentions and differentiation of these intentions (realization phase), and the transition of intentions into actions (execution phase). During the selection phase, goal-related cognitions initially have a determinant function, whereas expectancy-value as well as effort calculations are decisive during the later process. During the realization phase, calculations of effort based on expectancy- and value-related cognitions dominate. Thus, according to Pekrun (1986), the following motivational conditions of personality may be distinguished: (1) goals, wishes, and intentions, which are stored in memory ("goal structures"); (2) "expectancy beliefs" (e.g., action-outcome expectancies), and (3) "valence beliefs"² (affective and emotionally neutral subjective evaluations of objects and actions). Each of the three conditions may be hierarchically grouped, and range from highly complex and general to simple and concrete goals, expectancies, and valences. Expectancy and valence beliefs can also appear as integrated expectancy-value beliefs. All three of the above-mentioned motivational personality conditions are conceived of as cognitive structures in terms of persisting memory components. Thus, they also possess explanatory value for interindividual differences in motivation. This, however, does not apply to the traditional motive concept, which in most cases, is not based on real structures within the person. For this reason, motives are classified under purely hypothetical dispositional concepts.

According to Pekrun, a thematic distinction can be made among goal structures; for example, need-related, achievement-related, or social goals, wishes, and intentions can be distinguished. In addition, goals and intentions can, of course, be grouped as situation or domain specific partial structures (e.g., achievement-related intentions in the domain of mathematics). This also applies for expectancy and valence structures.

Expectancy structures may also be classified into more specific, partial structures. For example, action-control, action-outcome, outcome-consequence, situation-consequence, and consequence-consequence expectancies may be distinguished from one another. Causal attributions may also be classified under expectancies.

Valence beliefs, like expectancy beliefs, refer to actions and the outcomes and consequences of action. Valence beliefs represent the subjective values of particular objects or actions. Valences may be

²Beliefs mean the lasting, stored form of expectancies or valences, which form the basis of single expectancy or valence cognitions.

affective (when an object is linked with preceding, accompanying, or subsequent feelings) or emotionally neutral (when an object is cognitively evaluated as significant). Valences involving objects, which are experienced as desired goal states, may be described as normative valences. The close association of goal and valence structures becomes clear when noting that cognitions related to goals and intentions may be interpreted as representations of normative valences. Both types of cognition include behaviors, behavioral traits, or behavioral outcomes and consequences which are perceived as desirable states.

The differentiation between intrinsic and extrinsic valence is noteworthy in this connection. Intrinsic valence exists when an object (or an action) is directly linked with a person's emotions or when its importance is not dependent upon its relationships with other objects. That is, the object is valent within itself. Extrinsic valence exists when an object (or an action) becomes valent only through its relationship (usually instrumental) with other objects. As such, extrinsic valences would generally be emotionally neutral. With respect to action, intrinsic motivation means that the motivational goal exists subjectively within the intended action itself. Extrinsic motivation exists when the goals are to be found beyond respective actions.

Those personality-specific determinants of the motivational process (during achievement-related actions) defined by Heckhausen (1977a, 1977b), e.g., incentive weights, standards and attributional tendencies, can also be categorized among the cognitive structures in Pekrun's model.

Theoretical approaches still exist which attempt to assess motivational constructs in terms of summary motive constructs (e.g., Boekarts, 1986, 1987; Harter, 1981; Lloyd & Barenblatt, 1984; Whitehead, 1984). However, instead of motives, these approaches are referring to as motivational orientations. These theoretical constructs were not developed to add to the framework of general psychological thought, but to better predict learning behavior and achievement within the school context. Harter (1981) distinguishes a total of five components in her construct of intrinsic vs. extrinsic motivational orientation: (1) learning motivated by interest and curiosity, (2) preference for challenging work, (3) desire to work independently, (4) internal vs. external criteria for success or failure, (5) independent judgement. Undeniably, it makes sense to assess all of these components and evaluate their effects; however, it is questionable if all of these components must be regarded as part of one construct.

Previous motive and motivation theories have usually neglected one aspect, namely the object or content of action. When certain general motives of behavior are postulated (e.g., the achievement motive), one can use them to explain why a person does something. In this case, what a person does, i.e., what objects or issues s(he) attends to, remains unresolved. Interest theory and theoretical approaches addressing content-oriented motivation try to solve just this problem (e.g., Lind, 1975, 1976; Nenniger, 1986). They attempt to describe and explain relationships between persons and objects or topics, which are not determined by external reinforcement and object-unrelated instrumental purposes. The criterion of specificity regarding the content or object of motivational factors is of central importance in explaining interindividual differences in knowledge (cf. Section 2), since knowledge is only acquired with respect to specific content areas. The following will briefly describe theories of interest and content-related motivation.

Interest, according to the Educational Theory of Interest (Prenzel, 1986; Prenzel, Krapp, & H. Schiefele, 1986; H. Schiefele, Haußer, & Schneider, 1979; H. Schiefele, Prenzel, Krapp, Heiland, & Kasten, 1983), is not conceived of as a special type of motive, but instead as a specific person-object relation (po-relation). Features of such a relation include cognition (representation of the object), emotion (predominantly positive emotions towards the po-relation), and value (high ranking of the po-relation within the individual hierarchy of values). The main characteristic of interest is the self-intentionality of one's involvement with an object: actions stemming from interest are not instrumental, i.e., they do not function to fulfill purposes or goals unrelated to the object. Using Pekrun's (1986) terminology, one might say that actions due to interest and the object of these actions possess intrinsic valence. This latter aspect, namely the intrinsic value of objects or topics is an important criterion of interest. Actions occurring as part of a particular interest are intrinsic, since their valence is not dependent on relationships to other objects (e.g., certain action outcomes) existing apart from the particular object of interest. Some interest-related actions (e.g., practicing skills) may, however, be "instrumental" with respect to certain objectives (e.g., learning to play the piano) which are in turn a part of the object of interest. Such actions are intrinsically motivated, only to the extent that they are directed towards objects possessing intrinsic valence. Thus, the concept of interest may be seen as a scheme within a person's structure of valences, linking a multitude of individual valences of actions, action outcomes, and action consequences with one another³. At least in some instances, interest can explain why certain actions have intrinsic valence. They can have intrinsic valence because of their relation to a certain topical domain, which is attached with positive emotions (affective quality of the po-relation) and ascribed with high subjective significance (value aspect of the po-relation).

Nenniger (1983, 1986, 1987) is one of the most important authors having devoted his attention to the concept of content-related motivation. He differentiates two components of content-related motivation, namely "readiness for work" and "interest" (e.g., in mathematics). Nenniger's concept of interest as it is expressed within the latter component (or scale), is similar with respect to its defining features to the concept of interest described above. This is exemplified when comparing items from Nenniger's (1983) questionnaire on interest in mathematics with characteristics of interest described by H. Schiefele et al. (1979, 1983). In contrast, Nenniger's inclusion of the scale "readiness for work" within his concept of content-oriented motivation seems somewhat problematic. The results of both Eigler et al. (1983) and Winteler & Sierwald (1986) indicate that interest and achievement-related motives ("readiness for work") correlate weakly and that they have different effects on cognitive measures. According to the criticism of summary motive constructs, the inclusion of both components as parts of one motivational construct should be newly considered.

³Certainly, interest is more than just an object-related valence scheme. Specific parts of an individual's goal and expectancy structures can also be linked with interest. An applicable analysis, however, cannot be made at this point.

3.3 The impact of motivational personality factors on object-related engagements

The next step in our diagram involves the impact of motivational personality factors on object-related engagements, i.e., on observable actions and cognitive processes of knowledge acquisition. The impact of motivational factors on the formation of knowledge structures is mediated by object-related actions and cognitive processes. Object-related actions can, but must not necessarily be accompanied by knowledge acquisition processes. They are significant as prerequisites for the acquisition of knowledge. In order to learn something about a certain topic, one must engage in such activities as attending lectures, buying a book and reading it, or discussing the topic with experts. The process of knowledge acquisition involves all internal, cognitive occurrences related to the assimilation and storage of new knowledge. Quantitative (intensity or extent) and qualitative features (kind) of the knowledge acquisition process determine the validity of resulting knowledge representations.

It is posited that motivational conditions have a threefold effect on object-related actions and knowledge acquisition processes (cf. Figure 1): (1) as antecedent conditions of the acquisitional process, (2) as motivational outcomes of specific effects (see below), occurring during or after actions or mental processes (see Section 3.4), and finally (3) emotional states, due to certain motivational personality conditions, may occur during the course of actions and knowledge acquisition processes (see Section 3.4). The first point will now be examined more closely.

The description of motivational personality factors in the last section focused on three motivational conditions of personality, namely goal beliefs, expectancy beliefs, and valence beliefs. These can now be analyzed and investigated for their individual impact on the acquisition and representation of knowledge. Further differentiation is possible within the three types of beliefs mentioned above (e.g., specific expectancy beliefs). The necessary amount of differentiation cannot be precisely determined on the basis of Pekrun's (1986) descriptions. Empirical studies must first be conducted to offer a basis for making such estimations. Certainly it is neither possible nor sensible, at this point, to make assumptions about possible impacts of all differentiable motivational personality conditions on knowledge-related processes. Thus, this section will concentrate on a selected, yet essential motivational condition for learning processes, namely the impact of content-related intrinsic vs. extrinsic valences of action (as parts of an individual's enduring structure of valences). Goals and intentions cannot be strictly eliminated in this connection, since they are, in fact, strongly related to valences, and even partially identical to them. The importance of distinguishing intrinsic vs. extrinsic motivation has been emphasized by many authors (cf. Ames & Ames, 1985; Deci, 1975; Harter, 1981; Ryan, Connell, & Deci, 1985).

The possible impact of different motivational personality factors on the extent and kind of object-related activities and cognitive processes will be demonstrated using two differently motivated individuals as an (hypothetical) example. It is supposed that both individuals are students in the same field of study. One studies because s(he) considers the topics in his/her major to be very meaningful, while the other student chose this major because of the high income possibilities after graduation. It is obvious that the students differ from each other with respect to the type of

valences and possible consequences (i.e., graduation and potential future earnings) they associate with study-related activities. The first student attaches intrinsic valence to study-related activities, while the second associates such activities with extrinsic valence. The example also illustrates a strong relationship between goal and valence structures (see above), since the different valences also reflect varying goals. While the second student is more concerned with reaching a high level of income, the first student is more concerned with studying certain personally relevant issues within his/her field (without viewing this involvement as a means of reaching certain topic-unrelated goals). From an interest-theoretical point of view, the field of study possesses intrinsic valence for the first student, and the student's actions (with respect to studies) are predominantly self-intentional. In the second case, the field of study has primarily extrinsic valence and study-related activities are mostly instrumental and directed toward study-unrelated purposes.

Thus, we are making a distinction between a person, for whom study-related actions and the field of study possesses intrinsic valence, and another person for whom studies and their related activities possess instrumental valence. As such, our example incorporates only the content, but not the strength of motivation. It is not difficult, however, to imagine that the power of the effects, which will be described in the following, vary continuously according to the strength of motivation (the impact of which will not be further discussed here).

With respect to observable activities, we assume that the first person is likely to attend lectures more frequently, be more attentive, and take better notes (extent of activity), while simultaneously participating in many other forms of study-related activities (kind of activity, e.g., leading discussions, attending lectures outside the university, attending conferences on the topic of his/her studies). The second student would attend lectures based on whether this effort is necessary for successfully passing upcoming exams. One would also expect this student to engage in fewer forms of topic-related activities (see Section 4.1). His/her study behavior seems to be generally determined by strategic considerations.

As far as cognitive processes (knowledge acquisition) are concerned, the intrinsically motivated person will, for instance, make more elaborations or inferences when reading a text (degree of processing). S(he) will be more eager to understand all issues presented in the text, and not just process those aspects, for example, which are necessary to pass exams (content of processing). In contrast, the extrinsically motivated person will be inclined to pay greater attention to and eagerly memorize those parts of the text relevant to exams.

Various theoretical approaches exist to describe the different levels of information processing and the intensity of processing (see Weidenmann, 1987). Probably the most well-known of these is the concept of "depth of processing" by Craik & Lockhart (1972; see also Cermak & Craik, 1979). In Craik & Tulving's (1975) revised version, this concept states that the more elaborately a stimulus (e.g., a word) is processed, the more permanently it is stored. The degree of elaboration is determined by the number of stimulus traits processed and the quality of the elaborations. The quality of an elaboration depends on the type of stimulus trait (e.g., phonemic vs. semantic traits of words) it is associated with, and the degree to which it becomes linked with available knowledge structures (see also Mandl et al., 1986). The concept of depth of processing (or spread of encoding, as

described by Craik & Tulving) covers a substantial part of the object-related cognitive processes illustrated in Figure 1. Should this assumption prove valid, one can posit that the impact of motivational factors on the quality of developing knowledge structures is mediated primarily by the intensity of processing.

One can only speculate about the extent to which different degrees of activation function as mediators for the above-mentioned motivational effects. It seems plausible that differences in activation have explanative value, especially when two individuals vary with respect to the same motivational dimension, and when there is a marked difference between them regarding the strength of motivation. The explanative value of activation is more difficult to determine, however, when comparing two individuals with the same amount of, but topically divergent motivation (as in the above example). Nonetheless, for our example, suppositions can be made regarding the different degrees of activation. This is possible because, according to Pekrun (1986), extrinsic valences, as opposed to intrinsic valences, are usually emotionally neutral. Thus, one can conclude that they are accompanied by lower degrees of activation.

Thus far, the discussion has focused exclusively on those processes needed for the formation of knowledge structures. Even though these processes are the actual topic of the present article, brief comments will also be made concerning the application of stored knowledge. It is obvious that cognitive performance, in terms of products of intellectual activity (e.g., the solution of a mathematical problem), also involves mediating processes. They may be broadly described as internal processes of the utilization of knowledge (e.g., problem solving and retrieval processes). Motivational influences also play a meaningful role in this area (cf. Dörner, 1976; Hesse et al., 1983; Kuhl & Wassiljew, 1985). This is especially evident in the psychopathological realm. One example is the limited access to positive, self-related information in the memory of depressive individuals, who could indeed be characterized by a strong motivational deficit (Johnson & Magaro, 1987). So-called "motivated forgetting", which is (for instance) inherent in the psychoanalytical concept of repression (Eagle, 1983) is another example.

3.4 The role of specific (peri- and post-actional) effects of object-related engagements

At this point I would like to address motivational influences which arise during the course of object-related activities. The emotional and cognitive effects as well as the regulation effects described in Figure 1 play a central role in this connection. Their incorporation into the diagram was stimulated by various theories of intrinsic motivation (especially those approaches by Deci, 1975, and Csikszentmihalyi, 1975) as well as Prenzel's (1984, 1986) theory of the working principles of interest.

On the basis of Prenzel's (1986) analysis, three groups of direct effects of action can be distinguished, which are instrumental to the maintenance of intrinsically motivated and interest-oriented action. These effects partly accompany action (peri-actional) and partly occur as outcomes of action (post-actional).

- The following effects can be listed on the cognitive level: seemingly resolvable discrepancies between available cognitive structures and experience (cf. Hunt, 1965, intrinsic motivation through incongruence) and

increase in competence or knowledge.

- The experience of tension and flow⁴ (Csikszentmihalyi, 1975), being attracted to an object (positive affective colouring), and feelings of competence (cf. Deci, 1975; White, 1959) have fostering effects on the emotional level.

- At the level of regulation or control, it is assumed that the experience of conscious regulation of emotional and cognitive effects and the conscious setting and controlled pursuit of long-term goals contributes to the maintenance of the respective actions (cf. Deci, 1975, motivation through the experience of self-determination). Thus, the regulation effects are actually meta-cognitive effects.

The above effects of action may also be interpreted as intrinsic rewards or reinforcements. According to Bandura (1977), whether a reinforcement is to be viewed as intrinsic or extrinsic depends on its localisation (within or outside the person) and contingency (natural vs. voluntary). All reinforcements occurring within the person (e.g., physiological states, selfevaluation) or natural action outcomes outside of the person (e.g., sensoric effects of an activity, for example, when playing the piano) are referred to as intrinsic reinforcements. Thus, extrinsic reinforcements are the case only when a reinforcer is voluntarily given outside the person (reinforcement through others, e.g., material rewards, praise). According to Bandura's definition, the above-mentioned effects of action can be clearly categorized within the group of intrinsic reinforcements⁵. It is, however, plausible to assume that emotional outcomes of action take on a central position. Cognitive and regulation effects also have emotional components and consequences: The experience of increased knowledge leads to feelings of competence and the experience of control leads to feelings of selfdetermination or control.

Interpreting the above-mentioned effects of action as reinforcements is mainly supported by Csikszentmihalyi's (1975) concept of flow. According to this concept the experience of flow is one of the most important intrinsic rewards, contributing to the maintenance of enjoyable activities, which are independent from external support.

The stated effects of action are, however, not only significant for the maintenance of activities and po-relations (interests), and thus partly determine whether or not additional knowledge is acquired within a specific content area. They may also have an impact on actually occurring object-related engagements (especially on the process of knowledge acquisition), and therefore influence the formation of knowledge structures (cf. Figure 1). On the one hand, this influence is motivational, i.e., the occurrence of certain cognitive, emotional, and control effects motivates the continued and more intensive engagement with an object. A person, who experiences one

⁴Flow means that a person is extremely concentrated while executing an action, that the person is fully a part of the action, loses his/her sense of time, has a clear action-related goal, receives immediate feedback about achieving this goal, and experiences feelings of control (Csikszentmihalyi, 1975).

⁵The intrinsic-extrinsic differentiation by Bandura differs from that by Pekrun (1986; see Section 3.2). Bandura's definition is preferred, because it appears to be more useful in the present context (namely for characterizing the effects of action).

of these states or effects, e.g., while reading a text, may reread the text and/or be stimulated to imaginative elaborations.

On the other hand, the effects of action may have a direct influence on the process of knowledge acquisition, without being mediated by their motivational component. Particularly emotional effects, which appear in the course of an object-related activity, presumably have an important influence on the actual processing of information. The interaction of cognitive and emotional processes has been the subject of intensive considerations, empirical investigations, and theoretical controversies for a length of time (Bearison & Zimiles, 1986; Clark & Fiske, 1982; Lazarus, 1982; Mandl & Huber, 1983; Scherer & Ekman, 1984; Spies & Hesse, 1986). Various studies have demonstrated, that material (e.g., words), possessing affective quality (whether negative or positive), is more easily retained. Eagle (1983) and Thompson (1985) found evidence, that learning under emotionally stressful conditions leads to immediate low recall performance, while further forgetting does not occur over an extended period of time. In addition, emotions act as a selective filter while perceiving new information. They can lead to a deeper level of processing (when the content of learning is congruent with one's mood) and influence the retrieval of knowledge from long-term memory. The recall of information or events is facilitated if the mood at the time of learning is congruent with the mood at the time of testing ("mood-state-dependent memory", see Bower & Cohen, 1982). Thus, empirical evidence exists, indicating that emotional states play an influential (fostering and/or inhibiting) role in the process of knowledge acquisition.

Simultaneously, it becomes evident that emotional and motivational processes interact with each other. On the one hand, effects resulting from or accompanying actions exert influence on the underlying motivational personality conditions. On the other hand, the occurrence of the effects of action (particularly the emotional ones) is probably dependent on the persisting (pre-actional) conditions of personality (e.g., valence beliefs). This dependency is evidenced in two ways. Firstly, the probability of the occurrence of specific effects (e.g., the experience of flow) for one and the same action (e.g., reading a text) changes with varying motivational conditions of personality (e.g., intrinsic vs. extrinsic valence beliefs). Secondly, these conditions presumably influence the preference of such activities, which are more or less likely to result in specific effects.

4. REVIEW OF RESEARCH SUPPORTING THE POSTULATED RELATIONS

Results from various investigations are conclusive to the above discussed assumptions. Those studies which are most relevant to the present issue will be more closely considered in the following. Their presentation is oriented to Figure 1. First of all, a number of results regarding the relation between motivational personality factors and the extent and kind of object-related engagements will be reported. Secondly, studies investigating the correlation between motivational personality factors and various aspects of object-related knowledge structures are described. Finally, stemming from a critical analysis of earlier studies, two of our own studies on the relation between the degree of interest and the extent, content, and organization of associative knowledge will be presented.

In correspondence with the objective of the present article, we will solely review results concerning the relation between motivational factors

and the acquisition and representation of knowledge. Exclusively these relations were given theoretical examination in the preceding sections. Thus, the processes of knowledge application and their dependence on motivational factors have to be excluded.

The numerous studies, which mainly investigated the correlation between those factors (or components) being furthest apart in our diagram, namely motives (or motivational orientations) and cognitive performance, will not be discussed either in detail. A major part of these studies addresses the impact of achievement motivation (and to a lower degree of intrinsic motivation and interest) on cognitive performance (e.g., successful problem solving, academic attainment in terms of good grades). Little attention has been paid to mediating actions, processes, and cognitive structures. The results concerning the effects of different motives (e.g., achievement motive) on cognitive measures lack conformity (cf. Atkinson, 1974; Boekaerts, 1987; Harter & Connell, 1984; Krapp, 1984; Kühn, 1983; Kuhl, 1983c; Parsons, 1984; Rheinberg, 1976; Tiedemann, 1978; Trost, 1975; Wilcke, 1976). One important reason (among others, e.g., the method of measuring motives, disregard of situational factors) for the often controversial findings refers to the type of the applied achievement criteria, which are often formal and hardly differentiated (e.g., school grades). Various authors have criticized their application as measures of cognitive performance (e.g., Heckhausen, 1980; Säljö, 1981; U. Schiefele, Winteler, & Krapp, in press; Watkins, 1983).

Distinctly fewer studies exist, dealing with the impact of motivational personality factors on knowledge structures and knowledge acquisition, which form the basis of cognitive achievement. In contrast to simple achievement tests and formal criteria of performance, the quality of knowledge structures seems to be more expressive as a criterion for evaluating motivational influences on learning processes and learning results. In addition, the analysis of knowledge structures permits a more precise diagnosis of deficiencies in learning processes and instruction.

In the following, only studies are referred to, which applied meaningful criteria for measuring the level of object-related engagements and the quality of basic knowledge. Thus, the results of these studies give evidence to the relationships illustrated in Figure 1.

4.1 Motivational personality factors and object-related engagements

Investigations, dealing with learning styles or strategies are of great importance to the relationship, which will be discussed in this section (cf. Weinstein & Mayer, 1986; Wolfenden & Pumfrey, 1985). Whereas the majority of studies dedicated to this research issue examined the effects of learning strategies on the quality of learning outcomes, a few authors are concerned with the relation between motivational orientation and preferred learning style (e.g., Biggs, 1982; Entwistle, Hanley, & Hounsell, 1979; Watkins, 1982). The extensive research by Entwistle and his colleagues (e.g., Entwistle et al., 1979; Entwistle & Kozeki, 1985; Entwistle & Ramsden, 1983) deserves special emphasis. In several studies, concerning student learning, they were able to demonstrate that intrinsic motivation (as a personality trait), but not extrinsic and achievement motivation, corresponds to a learning orientation directed towards deeper understanding ("understanding-orientation"). The learning style (i.e., the cognitive engagement with an object) of intrinsically motivated individuals is characterized by the fact

that topics to be learned are more closely related with prior knowledge, i.e., with similar topics, concrete examples, and personal experiences ("deep approach"). In addition, analogies are formed and basic ideas are conceived without overlooking details and facts. Individuals who are motivated extrinsically exhibit a "reproduction-orientation" that corresponds to a superficial learning style ("surface approach"), which can be recognized by rote learning. An "achievement-orientation" prevails among those individuals who are achievement motivated. Their approach to learning is strategic, i.e., object-related engagements are variable and consist of a mixture of meaningful and rote learning, depending on external demands (e.g., an upcoming exam). Altogether achievement motivation leads to a learning style which is more similar to that of extrinsically motivated individuals. Further results concur that self-evaluated improvement within one's studies correlates positively with the understanding- and achievement-orientation and negatively with the reproduction-orientation.

4.2 Motivational personality factors and aspects of represented text-related knowledge

The investigations on reading comprehension and text learning constitute the area of cognitive psychology, which has included motivational factors most frequently (e.g., Asher, 1980; Baldwin, Peleg-Bruckner, & McClintock, 1985; Birkmire, 1985; Black, 1981; Flammer, Schläfli, & Keller, 1978; Hare & Devine, 1983; Rickheit & Strohner, 1986). These studies either used the reading intention or topic interest as a motivational variable. Topic interest was raised by experimental instruction or determined by interest tests. As Rickheit & Strohner (1986) mentioned, even though most of the studies were able to prove the impact of topic interest or specific reading intentions on text comprehension, they were using relatively rough reproduction measures (recall and recognition tests). Mediating cognitive processes (e.g., inferences) were also mostly ignored.

Empirical studies which applied more informative knowledge-based criteria to assess motivational influences on text learning are yet small in number. One example that deserves positive recognition is the study by Marton & Säljö (1984). They investigated the influence of varying degrees of personal affectedness (as a variation of the text-related interest) on cognitive processes during text learning and on aspects of text-related knowledge structures. Students, personally affected by the text content⁶, established more relations between different parts of the text, as well as between the text and the actual object or content described in the text. Consequently they were better able to understand the intentions and conclusions of the author. Those students not affected personally, put more emphasis on the superficial structure of the text and tended to memorize the content. They showed distinct deficits in comprehending the intentions and conclusions of the author. With reference to van Dijk & Kintsch's model of knowledge representation (1983; see also Perrig & Kintsch, 1985), it can be stated that the personally affected students developed a situation model, i.e., they formed a cognitive representation of the "situations" (or objects)

⁶The text dealt with the testing system of the department of education. The personally affected subjects belonged to this department, the non-affected subjects were sociology students.

described in the text. The non-affected students have in turn created a propositional representation of the text, i.e., they only stored the text as such (its superficial structure).

Säljö (1981) and Watkins (1983) found similar results. They were able to show that students who were understanding-oriented (see above) processed a given text on a higher level than reproduction-oriented students. A detailed analysis of the answers on text-related questions revealed that the understanding-oriented students were able to make connections among the individual parts of the text and draw general conclusions from the text. The reproduction-oriented students concentrated on fewer parts of the text, which were usually less important and not integrated into a coherent structure. Quantitative differences could not be observed when the text was reproduced freely.

In a genuine knowledge psychological investigation Schmalhofer & Glavanov (1986) tested the effects of different goal instructions (for reading a text) on the representation of text-related knowledge. They explicitly referred to van Dijk & Kintsch's (1983; see above) model and found evidence that subjects with the objective to gain knowledge establish a situational representation, whereas subjects with the objective to summarize the text form a propositional representation.

4.3 Interest and the extent, content, and structure of associative knowledge

Despite the improved integration of motivational and knowledge psychology, the previously mentioned studies show various deficits, which point to the still existing separation of both research areas. Entwistle & Ramsden (1983), in their study regarding the effects of different motivational orientations, only used data obtained from questionnaires. A more direct assessment of cognitive processes during the acquisition of new information was not attempted. In order to investigate achievement-related effects, the authors merely applied self-ratings to assess the amount of understanding and competence.

The more adequate studies in knowledge psychology employed differentiated tests to measure various aspects of stored knowledge. However, they did not refer to elaborated motivational concepts, but used experimental manipulations (goal instructions, variations of personal affectedness) or compared different learning orientations (which cannot be equated with the underlying motivational orientations) with one another.

In a recently conducted study, it was attempted to take both sides into greater account (U. Schiefele et al., in press). For this purpose the influence of study interests on the representation of knowledge related to subject matter was examined. The concept of interest used in this study is based on the Educational Theory of Interest (see above). Study interest (regarding the subject of educational science) was measured by means of the "Study Interest Questionnaire" (SIQ) developed by Winteler & Sierwald (1986). Aspects of knowledge (extent, content, and structure) were measured by a word association test. The subjects were first-year students of educational science. The results confirm, that highly interested students differ from less interested students in regard to quality, but not quantity. On the one hand, the highly interested students showed a higher degree of topical relevance (as judged by experts) with respect to their associations. On the other hand, their structural representation of given concepts was more similar to that of experts. Regarding the frequency of associations,

however, no differences could be observed. These results were replicated in a second modified investigation (U. Schiefele, 1987). In this study a number of additional variables was controlled (e.g., prior knowledge).

The absence of quantitative differences is also shown in other studies, which examined the different effects of the understanding- and the reproduction-orientation on learning outcomes (Biggs, 1979; Säljö, 1981; Watkins, 1983). Obviously, an intrinsic content-oriented motivational orientation does not influence "how much" one learns, but "what" one learns. As a consequence the mere amount of acquired knowledge (e.g., the frequency of associations to professional terms) cannot be seen as a valid indicator of content-related interest. Instead the kind of structural relations developed between different concepts and the extent to which these concepts are connected with professional knowledge (as opposed to "every day" knowledge) is crucial.

5. CONCLUDING REMARKS

The preceding theoretical considerations were intended to present and specify the emerging tendency towards the intensified integration of motivational theories and the psychology of knowledge. The question of how motivational factors influence the acquisition and representation of knowledge was selected from the many possible research problems deriving from such an integrational approach.

According to our theoretical analysis two kinds of relevant motivational factors can be differentiated: (1) motivational personality factors, and (2) motivational effects of action. Both factors are dependent on each other, but have partially different effects. Some of these possible effects (e.g., extent of elaborative processes, variety of object-related activities) were discussed and explained on the basis of concepts or findings, concerning the acquisition of knowledge (e.g., the theory of "depth of processing").

Previous studies, which dealt with the relationship between motivation and knowledge, have almost exclusively investigated motivational personality factors. The influence of the motivational effects of action, especially the emotional component of these effects (see Section 3.4), on the process of knowledge acquisition has been neglected. This remains as an important task for future research.

Another unresolved problem refers to the conceptualization of motivational personality factors. It does not appear to be useful to employ summary motive constructs in the traditional sense. This has been pointed out particularly by Heckhausen (1977a, 1977b). Especially when examining specific hypotheses, it will be advantageous to apply explanatory constructs (i.e., motivational personality traits), which are as differentiated and unequivocal as possible. The concept of interest must also be examined from this point of view. Separate testing of particular components (e.g., object-related valence beliefs) is required for the detailed analysis of the effects of interest on knowledge-related processes.

The research strategy pursued in our previous investigations (see Section 4.3) as well as in planned studies, consists of selecting relevant motivational personality features and demonstrate their influence on the representation of knowledge. The impact of motivational conditions on various aspects of the process of knowledge acquisition will be investigated in later studies.

In this article the attempt was made, to determine theoretically, which components of knowledge-related processes and structures are influenced by motivational factors and to clarify the nature of this influence. This attempt is closely related to a more general research goal. It is directed towards a more complete model of the process of knowledge acquisition and the representation of knowledge. The one-sided cognitive conceptualizations of the theories predominant in the psychology of knowledge are in strong contrast to the outstanding significance which is ascribed to motivational factors for the process of learning. Thus, it seems to be meaningful to promote the integration of these two research areas.

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