Psychotherapy for depression under the assumption of a "depression memory" due to a structural change in the neurobiological reward system- first empirical dates

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Abstract

Scientific studies show that not only drugs can cause profound structural physiological changes in the reward system, but also behavior. This can be done through positive (adding something pleasant = C+) and negative reinforcement (taking away something unpleasant = C- /) of a behavior that leads to a reduction in emotional distress. Based on a cognitive-behavioral-biological approach, Depression is seen here as a failed attempt to deal appropriately with emotional stress. A short-term, strong but of short duration emotional relief is achieved by avoiding action-activities that are associated with the stressful situation. It is assumed that operant conditioning processes, when this strategy is used frequently and over a longer period, lead to a restructuring of the neurobiological reward system. A neurobiological "representance" develops of the conditioning process can be described as a persistent "depression memory" and previous "relief strategies" are automatically triggered without any conscious intention. Previous other more favorable emotional regulations are declining. The “actional-inactivity” dominate the reward system and is the later behavior symptom of depression. The underactivity in the brain executive is accompanied by a cognitive overactivity to the point of brooding.
Initial empirical results from an IAS-Questionnaire study show that depression (and other mental disorders) is associated with a decline in interests and activities that constructively improve psychological state. This is accompanied by a decrease in life satisfaction, social competence, and other important psychological parameters. The dysfunctionality of the reward system represents a particular challenge for the therapist. In this context the therapeutic goal is to replace the risky behavior through constructive, highly rewarding alternatives. Therapeutic help should not be terminated until activity to cope with stressful situations, exercise in general, a variety of constructive affect regulation strategies and interests are established as stable habits. So that the reward system provides impulses to use alternatives for affect regulation instead of risky behavior.[1]

Key words

Reward-System; Dysfunctionality; Depression-Memory; Automatization; Alternatives

1. Introduction

A new approach is often initially fragmentary and is based more on the main scientific cornerstones than on the latest zeitgeist. A **key factor** in the cognitive-behavioral biological explanatory approach discussed here is the **neurobiological reward system**, which produces the **chemical messengers** to achieve a "**well-being**" and a "**balance**" of **stress-related negative feelings**. A malfunction of this system can lead to a strong reduction in the "reward-effective" behavioral repertoire (stress reduction, mood improvement, maintaining social contacts, increasing well-being). In the case of severe dysfunction, it is hardly possible to **feel joy** or interest **without engaging in associated risk behavior. Based**

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on operant conditioning processes, not only pharmacological substances (e.g. narcotics) profoundly alter the reward system, scientific findings on, for example, "problem gambling" show that **behavior can** also induce physiological **changes** in the **reinforcement system** (Grüsser et al. 2005; Bachmann, M., 2014; Bachmann, M., 2017).
Böning & Grüsser-Sinopoli (2008) in the context of gambling addiction: It can be assumed that any reward for the brain is reinforcing, regardless of whether the **reinforcer** is e.g. a **pharmacological substance** (e.g. narcotics) that acts directly on neurotransmitters such as the dopaminergic reward system **or whether it is behavior which, like other environmental stimuli, is directly established via conditioning processes**. The **automation of dysfunctional behavior** should **only be understood in the context of neurobiological processes**.
The reward system dysfunction is characterized by the development of a neurological memory representation based on the "addiction memory". This biographical memory is based on a structural change in the reward system and causes risky behavior to become automated and can be carried out without conscious intention. In order to restructure the neurobiological reward system, the **development of alternatives to emotion regulation** is an **important goal** for these forms of behavioral disorders. Empirical studies show that dysfunction of the reward system is a crucial core mechanism in a number of mental disorders and hinders the abandonment of undesirable behavior (Bachmann, 1990; Nordbø et al. 2006; Münte, 2008; Figee et al. 2011; Fontenelle et al., 2011; Choi et al. 2012; Keating et al. 2012; Steinglass et al. 2012; Monteleone et al. 2018; Bachmann, M. & Bachmann, A.A., 2023a).

In the context of **dysfunction in the reward system** in psychiatric disorders (alcohol dependence, schizophrenia, major depressive disorder, bipolar disorder, attention deficit/hyperactivity disorder), Hägele et al. (2015) formulate: "… that neurobiological research in psychiatric disorders can be targeted at ***core mechanisms*** that are in all likelihood to be **implicated in a range of clinical entities**. This approach can be promising for the understanding of psychiatric symptoms and for the **development of new treatment strategies**."
During reward anticipation, they observed significant group differences in ventral striatal (VS) activation: patients with schizophrenia, alcohol dependence and major depression showed significantly less ventral striatal activation compared to healthy controls. Depressive symptoms correlated with dysfunction in reward anticipation regardless of diagnostic entity.

It is by no means intended to classify depressive disorders or other diagnoses as dependencies. Rather, it is about improving the methods, stopping the self-perpetuation of a damaging behavior by reestablishing alternative structures, for a constructive feeling regulation in the reward system. The medical and psychotherapeutic treatment of **disease-specific symptoms**, causes of disease emergence, psycho-social consequences of the disease, effects on the general way of life and health as well as relapse prevention, are **still different in the clinical pictures and treated by the conventional methods**. For this reason, it is indispensable to additionally use the current literature on the treatment of depression, as only a partial aspect of the disease (hypotheses on interactions between psychological and neuronal processes) is considered in more detail here.
The basic assumptions of the approach to a "**depression memory**" presented here are explained in more detail below.
Kuhl (2001) speaks of **a deformation of the reward system** in connection **with severe depression**[2]. In his opinion unprocessed fears and external conditions can be the impulse for a conditioned, nearly

[2] More, in an excerpt, about the appearance of depression in the internationally recognized diagnostic criteria ICD-10 (WHO, 2004). In typical mild, moderate, or severe depressive episodes, the patient suffers from lowering of mood, reduction of energy, and decrease in activity. Capacity for enjoyment, interest, and concentration is reduced, and marked tiredness after even minimum effort is common. Sleep is usually disturbed and appetite diminished. Self-esteem and self-confidence are almost always reduced and, even in the mild form, some ideas of guilt or worthlessness are often present. The lowered mood varies little from day to day, is unresponsive to circumstances and may be accompanied by so-called "somatic" symptoms, such as loss of interest and pleasurable feelings, waking in the morning several hours before the usual time, depression worst in the morning, marked psychomotor retardation, agitation, loss of appetite, weight loss, and loss of libido. Depending upon the number and severity of the symptoms, a depressive episode may be specified as mild, moderate or severe.

autonomous reaction of the reward system **to remain passive in the brain function of the executive**. Being unable to move, to perform necessary activities and to sustain a structured everyday life anymore. According to Kuhl, this process in the brain is accompanied by an **overactivity in the legislative cognition area** of the thinking and will function. This combination would correspond to the paradox of intense thinking about one's own goals and the inability to translate them into action.

The **conditioning process in the case of depression** is characterized by the fact that a person**,** in a stress situation that is difficult for them to handle, responds with avoidance of action-activity[3] and movement (passivity in behavior). It can be assumed that the avoidance of action-activity, taking stress factors into account, can lead to a strong short-term but not long-lasting emotional relief.

According to the explanatory approach of operant conditioning, the reduction of the negative emotional state / increase in well-being and the associated stimulus generalization leads to an increased probability that the chosen **avoidance strategies** will occur more frequently and get a **dominant position in the reward system**.

A **progressive operant conditioning process,** positive and negative reinforcement (Kanfer et al., 2000), causes a reorganization of the reward system out of which a persistent "**depression memory**" evolves, which is the **representance of the automatic reaction** to associated stimulation. The stress-reducing strategies used are the later behavioral symptoms (avoidance of, action-activity, movement, and a lack in realization of behavior goals) of depression (Beck et al., 2010). Although, initially, they have a (affective) relief and stress-reducing function, they often do not contribute to solving the stress-inducing situation. Instead, it is to be expected that a frequent use of these strategies will further worsen the negative starting position, whose "**long-term**" **negative consequences are not considered.** This increases the likelihood of reacting again with avoidance and action passivity.

The theoretical considerations have no end in themselves. They lead to hitherto possibly neglected therapeutic implications. An important **conclusion is to revive or rebuild constructive coping strategies** for managing stress / well-being, thereby **overcoming the dominant position of the dysfunctional strategies in the reward system**. The therapeutic cognitive-behavior-biological approach, which aims at a structural change of the reward system, poses special challenges for the practitioner. To achieve the most balanced and satisfying way of life, as many **behavioral changes** as possible **that are incompatible with the course of the disease** should be aimed for.

The **"irrational / unfavorable cognitions" contribute significantly to the onset and perpetuation of depression**, **but, at an advanced stage of the disease, are no longer the deciding factor in its upholding.** It is plausible that, in psychotherapy, (see Kuhl, 2001) a behavioral structure must be added to the "cognitive restructuring." To get a person back to activity, "**action components**" (e.g. sports including competitions, exercise, other forms of being active) **should be included in the treatment**. They may even require special therapeutic attention for a period until they develop into stable habits. In this way, hyperactivity in the cognitive (legislative) area can be stopped.

Grawe (2004, p. 18) formulates the importance of **neurobiological correlates in psychotherapy in general**: "If all psychic processes are based on neuronal processes, then altered mental processes underlie altered neuronal processes. We can prove that psychic processes can be effectively and permanently changed by psychotherapy. As a result, psychotherapy can permanently change neuronal processes and structures. Psychotherapy, **when it works, works by changing the brain**. If it does not change the brain, it is not effective either". Brain research results on the plasticity of brain structures support the notion that the inclusion of causative physiological factors (here, structural changes in the reward system) has a major impact on the success of therapy. A **greater part of the behavior disorders seems to be because stress or crisis management failed**. Grawe (2004, p. 159) on the importance of stress for the development of Depression and Posttraumatic Stress Disorder (PTSD): "Until recently, it has been fairly certain that the damage to the hippocampus in PTSD patients as in depressions is due to a

[3] Action-activity vs cognitive activity

temporary or longer lasting high cortisol level. " When stressful situations result in exhaustion and reduced perception, the response repertoire is likely to be generally limited, and it is difficult to successfully influence causative factors and / or to choose strenuous strategies to relieve negative emotions. In addition, it should be considered whether a person has generally learned a rather limited repertoire dealing with psychologically stressful situations and / or for example, **unresolved traumas additionally increase the level of stress.** Stressful situations (such as "ongoing psychological tension") can be triggered by multiple factors. Who or what causes the psychological stress, is this identifiable for the affected person? By lack of transparency, countermeasures failed early and increase the negative feeling: "Whatever I do, it doesn't help."
It is hard to doubt that that the degree of difficulty of **a desired psychic change is** not **influenced significantly by the "quality" of the physiological correlates** - in this case deeper-lying, **predominantly autonomous brain structures of the reward system**. It should also be noted that cognitive schemas are involved at every stage of the illness, both at the onset and during the maintenance of the illness, but at a certain level of depressiveness they no longer play a primary role in its maintenance.

2. Development and maintenance of depressive behavior using the example of ongoing stress situations

2.1 Conditions of emergence

In Figures 1 and 3, based on the SORKC-Model by Kanfer et al. (2000), an operant conditioning process for the development of depressive behavior, including the restructuring of the reward system, is presented (see first Fig. 1).
Initial point is a stress situation (S), e.g. "ongoing concern", a person **reacts with avoiding of action-activity, movement** (R). This leads to a short-term strong but not sustained emotional relieving (immediate consequence C_1: positive C + "something pleasant add") and negative reinforcement C- / "something unpleasant take away"). Contingence "K" = frequency of occurrence with which (R) is followed by C1: At a higher frequency of this Sequence "avoidance of action activities and movement" / "Short term strong but non-durable emotionally relief", the reward system in (O) is restructured and the maladaptive strategies used assume a dominant position in it.
Long term negative consequences (C_2) of this strategy (fifth column lower arrows) additionally burden the negative emotional state of the initial situation. In turn, the cumulative psychological stress increases the level of the **behavior symptoms of Depression**.

From a neurobiological perspective, Hüther (2012) describes the development of self-defeating monistic behavioral patterns that make mood enhancement very one-sided: The buildup of determining neural interconnection patterns is the greater, the more often certain strategies in dealing with negative feelings of a person are used during his development and subjectively evaluated as particularly successful. The short duration of the positive state fast leads back to the, often aggravated, negative initial mood. The need for the quick-reward effect is thus generated again and again.
An "own-dynamic" arises which can be described psychologically as a continuous circle (circulus vitiosus) (see Fig. 2).

Apparently, when adopting a stress management strategy in the (predominantly) autonomous area, the brain does not seem to differentiate between constructive (from a long-term perspective) and harmful behavior. As this conditioning process progresses, alternative coping strategies become increasingly less available and it becomes difficult to do something that only has a positive effect later, possibly after considerable effort and time. Self-doubt increasingly arises as to whether one can still persevere in activities with higher potential effort and do something that improves the situation in the long term.

Stimulus (S)	**Organism (O)**	**Reaction (R)**	**Immediate Consequences (C_1)**	**Longterm negative Consequences (C_2)**
Stress situation: E.g. mobbing in the workplace (complex internal / external stimulation situation). Multiple stress Factors: Who or what triggers the stress? Conflicts? Overwork? Bad atmosphere? Existential anxiety? Rejection? Discrimination?	**Brain functions**: (1) **Legislative**: Cognitions. (2) **Executive**: Movement / action / behavior realization. (3) **Reward system**: Predominantly autonomous brain function (create emotional balance).	**Coping strategies**: (1) **Legislative**: Increased cognitive activity (think hard, finding solutions, brood). (2) **Executive**: Avoidance of action-activity and movement. (3) **Reward system**: Increased impulses to use the maladaptive coping strategies more intensively.	**Short term** strong but non-durable emotionally relief.	An **actions-active problem solving is avoided / omitted**. Increased cognitive search for solutions: Intensive reflection, brooding, self-doubt. Feelings of guilt because of the failure to act problem-oriented. Existing constructive "coping strategies" are declining. Longer term negative consequences of the maladaptive strategies worsen the starting position.

(K) Frequent repetition of (R) and (C_1) restructures the reward system (3). **A**

Longer term negative consequences increase the stress level of the initial situation. **B**

In **Fig. 1**, **operant conditioning processes** (Kanfer et al., 2000) [positive & negative reinforcement] lead to an increase in the occurrence of maladaptive coping strategies and neurobiological changes in the brain areas (O) of the (1) legislative, (2) executive, and particularly the (3) reward system (**see top arrows A**). In the longer term (**see bottom arrows B**), the stress level (S) of the initial situation increases.

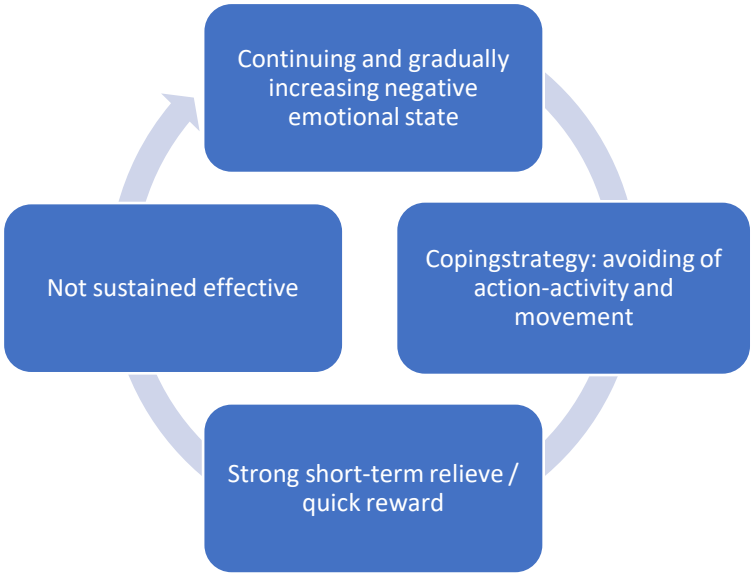

Fig. 2. Circulus vitiosus: negative emotional state and increased use of fast-acting but no longer-lasting positive coping strategies.

2.2 Factors of maintenance

The next figure (see Fig. 3) shows that a "depression memory" (O) develops as a result of a advanced stage of the conditioning process. Previously neutral external or internal stimuli (S), such as side effects of the psychological stress (e.g. negative cognitions, emotional states) are associated with the maladaptive coping strategies. In addition to the possibly poorly understandable (multifactorial) initial stress situation (S), they are now capable of triggering the behavioral symptoms of depression (R), the **avoidance** strategies, nearly reflexively. A clearly formulated wish (Böning & Grüsser-Sinopoli, 2009) does not have to exist (e.g. be passive, stay in bed). The cause of the onset of the disease symptoms is often unknown because it is triggered by previously neutral, conditioned stimuli.
The **lack of identifiability of the "stress trigger" reinforces the feeling of being helpless** exposed to the disease symptoms.

S	O	R
The psychological stress increases by: • The (multifactorial caused) unresolved "ongoing psychological stress" situation. • **Stimulus generalization,** associated previously neutral, external, and internal, stimuli trigger the depressive behavior (e.g. accompanying signs of the stress situation, banal situation characteristics, stressful thoughts, other stressors, general malaise, feel otherwise hurt, a deficit of positive experiences or "feel good chemistry "). • **Lacking ability to cope with life**.	**The chosen coping strategies** have occupied a dominant position in the reward system: • The consequence of the restructuring of the reward system is the emergence of a "**memory of depression**", which reacts to the conditioned stimuli nearly "reflexively". • **Underactivity** in the **executive** (action-activity, movement). • **Cognitive overactivity** in the **legislative** (worrying a lot, looking for solutions, brooding).	**Behavioral symptoms of depression / reduction of control in executive functions:** • Predominantly automatic reaction with **avoidance** of action-activity, movement, behavior realization.

Fig. 3: In the advanced stage of the conditioning process, depression memory is characterized by the fact that maladaptive behavior triggers predominantly automatically in a phased or chronic manner and causes inactivity in the executive (**avoidance** of action-activity, movement, behavior realization) and overactivity in the legislature (think a lot, ponder, search for solutions).

By an increasingly difficult life coping it comes to an increase of emotional burdens. This can be the result of a combination from psychological, physiological, social, and economic consequential damage. The last is an indication of the problem that "constructive" behavior changes are be imaginable, but because of reduction of control in "executive brain functions", difficult to translate into concrete actions. The symptoms of the disease are **additionally triggered by (previously neutral) stimuli**, which the **person may not associate with the "ongoing psychological stress" situation**.
The **dysfunctional coping strategies themselves have become a major problem**. The formerly short-term positive effect of **passivity in executive behavior** has fallen sharply, reversing more and more to the contrary, without any alternatives being available. Deeper brain regions of the reward system, responsible for reflexes and automatic responses, perform important functions of behavior control. The influence of reason and logic is greatly reduced and the patient often becomes a "helpless observer" of self-harmful behavior (see Fig. 4).

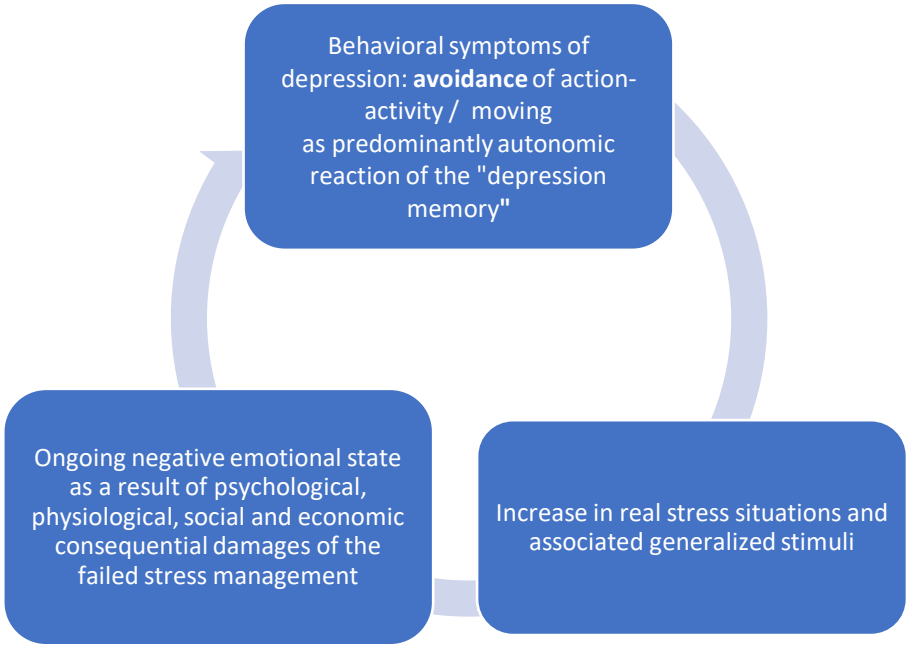

Fig. 4. Circulus vitiosus: Depression as a conditioned, approximately autonomous reaction.

The question will hardly be answered within which time periods and contingencies (frequency of occurrence C +, C- / after the reaction) the operant conditioning process expresses a depression memory. When asked which situation triggers a depressive episode, depressed people often have no concrete answer. They experience the deterioration of their mood as a "trapdoor-like" process. In longer reflective discussions, in which a higher degree of relaxation and self-exploration is guaranteed, they **recognize** causes (**triggering stimuli**). Insights into the underlying conditions of the onerous situation **reduce the sense of helplessness** and open ways to deal constructively with these situations and develop alternative coping strategies. The "**reduced control**" **about one's own options for action** is irritating for those affected. On the one hand, there are thoughts of being unable to handle the simplest things, no longer coping with life. But the whole situation can be ambivalent. On the other hand, new hopes sprouting, perhaps "tomorrow" or at another opportune moment, to make a new attempt to put goals and intentions into action. For this purpose, however, there are no sufficiently concrete planning and behavioral approaches (for example the smallest achievable steps), so that the "good will" in turn does not lead to desired behavioral changes and target realizations.
Depression memory and **risk of relapse persist**: Experiences in the field of addiction and the treatment of depressive patients suggest that the problematic memory structures persist, even though, after the establishment of alternative behavior, they no longer play a dominant role. A certain vigilance is need, however, since the depression memory with appropriate stimulation can continue to trigger an autonomous depressive reaction and thus a relapse.

The development of a “depression memory” summarized:

- To restore the **biochemical status** for a "**psychological balance**" in a stressful situation, a short-term strong but not permanent emotional **relief strategy "avoiding action-activity and movement"** is used. These are the later behavioral symptoms of depression.
- A **basic problem solving is omitted**.
- In a rewarding neural substrate in the brain (the mesolimbic reward / motivation system), messenger substances (such as dopamine) haven been secreted.
- In a **comparable situational condition** (stimulus constellation), a person remembers the "reward effect" which greatly improved the emotional state in the short term of behavior and repeat it.

- Through **frequent repetition** of the increasingly maladaptive strategies of avoidance and passivity in action, **operant conditioning processes** bring about a **restructuring of the neurobiological reward system** in the form of the establishment of a persistent **self-damaging** "**depression memory**".
- By an associated stimulation the depression memory **automates the reinforced behavior "avoidance of action-activity" and "lack in realization of behavior goals."**
- The maladaptive **strategies** (behavioral symptoms of depression) **occupy a dominant position in the reward system** and can be **triggered approximately automatically by multiple stimulus constellations** (stimulus generalization).
- In the brain, there is an **overactivity** in the brain area of the **thinking** and will function (legislative) and **underactivity** in the executive, the movement activity and action control.
- "**Longer term" negative consequences** of maladaptive strategies **worsen the initial situation** and in turn increase their use.
- Adequate stress management strategies are neglected and abandoned.

Excursus: **Unfavorable ("unrealistic") cognitions**

The mutual influence of **behavior, cognitions**, **emotions, and bodily state** should in principle not be bound to any order, so that therapeutic interventions are theoretically possible at every influencing factor (cf. Gross and Thompson, 2007).

Previous experiences of one's own "helplessness" in being able to influence one's own situation and emotional state sufficiently positively lead to unfavorable (whether they are unrealistic is controversial) "cognitive schemata". For example, giving up more quickly ("I can't do it anyway, I'll feel even worse after failure") and a lack of self-confidence ("I'm always unlucky"). These cognitions can be both a cause and a consequence of mental illnesses and can hinder the development of new, positively effective actions.

At any stage of disease development, adverse cognitions may be involved and contribute to the omission of concrete actions. However, the cognitive approach does not sufficiently consider that physiological "resistances" (structural changes in the nearly autonomous reward system) play a crucial role in maintaining depressive behavior.

From a cognitive therapeutic perspective, the negative thoughts are disputable and can be changed. However, additional support in dealing with, a gradual expansion of the action-activity, beginning with the "smallest steps", and the successes experienced in the process can be superior to "pure debating".

The cognitive model according to Beck et al. (2010) uses three assumptions to explain the psychic substrate of depression:

1) the cognitive triad (negative view of oneself, the future, and the environment),
2) the schemes (to neglect all experiences),
3) the cognitive errors are maintained despite objective evidence of positive factors in life (erroneous information processing).

One way to understand the depressive disorder is to assume two types of reality organization, one primitive and one mature. Beck et al. (2010, p. 45): "Obviously, depressive people tend to structure their experiences in a relatively primitive way. They tend to judge events that happen to them in their lives undifferentiated and globally. The meanings that are used to control their consciousness are rather extreme, negative, categorical, absolute, and judgmental. The corresponding emotional reaction is therefore rather negative and extreme. In contrast to this primitive way of thinking, in mature thinking life situations are automatically processed in terms of many dimensions and qualities, rather than a single category.

Valuations such as "primitive" or "mature" are dispensable if the biological factor (dominance of dysfunctional structures in the reward system) is included.

3. Treatment

3.1 Depression as a predominantly autonomous “reward system” controlled reaction

The SORC schema (behavioral analysis fig. 1) not only provides important clues for the genesis, but also for the therapeutic proceed: what is the **individual situation** (S), the **personal** cognitive and executive symptoms (O), reactions (R) short- and long-term consequences (C_1, C_2).

Although other factors of treatment are also considered, the focus here is on the therapeutic approach of reconstructing the reward system and reversing the dysfunction. Based on our scientific research, we have designed a manual to help develop alternatives to risky behavior and restore the reward system. Subjects rated the extent to which they were already engaged in certain interests and activities and whether there was a desire to increase engagement. Information on the pros and cons of each interest and activity is provided and detailed working papers encourage discussion on whether change requests are realistic and can be implemented. Which factors can promote or hinder the process of developing new stable habits and are able to remove maladaptive emotion regulation from its dominant position in the reward system (Bachmann, M. & Bachmann, A. A., 2023a)?

Headword-like is a comparison of the postulated **disease course** and **treatment process**, following the arrows, shown in Fig. 5.

The maladaptive "coping strategies" to develop imperceptibly to the burden. Despite good intentions and intense thinking (overactivity in the cognitive domain), attempts fail to realization behavioral activities that are important for the conduct of life. Due to the potentially multifactorial causes of stress as well, as the conditioned (generalized) stimulation by previously neutral stimuli, a plausible cause of the negative emotional state and its extent is often not sufficiently recognizable.

To stop the “own-dynamic” that describes the reduction of control in executive functions, the treatment is done in reverse order to its emergence. The most recently shown symptoms (avoidance of movement, action activity) are the first to be included in the therapy to achieve a **gradual restructuring or rebuilding of the reward system**. The focus of the therapeutic intervention is initially on eliminating the dominance of the symptoms of depression (avoidance of action-activity, movement,) in the reward system and to interrupt the "automatic" of the depression memory. Intensive help assistance can be necessary to overwhelm the resistance of the dominant problematic “affect regulator” in the reward system, to find the most beneficial alternatives and **firmly anchor them in the reward system**. Advances in the activation of alternative rewarding behavior create the prerequisite to work on the initial causes of the disease. This in sense of come into action-activity / movement and the expansion of a diverse interests and activities spectrum. The mutual influence of behavior, cognitions, emotions, and bodily state should in principle not be bound to any order, so that therapeutic interventions are theoretically possible at every influencing factor (cf. Gross & Thompson, 2007). According to studies by De Jong et al. (1980, 1985) and Hautzinger et al. (1989, 2010), the reduction to purely "cognitive" elements does not provide adequate treatment for depression.

For example, patients in a combination treatment (cognitive plus behavioral therapy), but also control waiting conditions, achieved better outcomes than those who received exclusively cognitive treatment. In addition to the cognitive restructuring, activity building and social competence training were carried out in the combination treatment. Including existing resources (Grawe & Grawe-Gerber, 1999), therapy planning must include both constructive short-term and long-term effective coping and feel-good strategies that positively influ-ence the emotional state and improve the general living situation. It is unlikely that all "short-term strong but not of longer duration" coping strategies will have the same potential to become destructive. This question may possibly be included in future empirical studies (see below). Depression and addiction mean not doing many other things. Kuhl (2001) points out that, for the most part, severe depression is characterized not so much by experiencing negative emotions, but more by the lack of positive emotions.

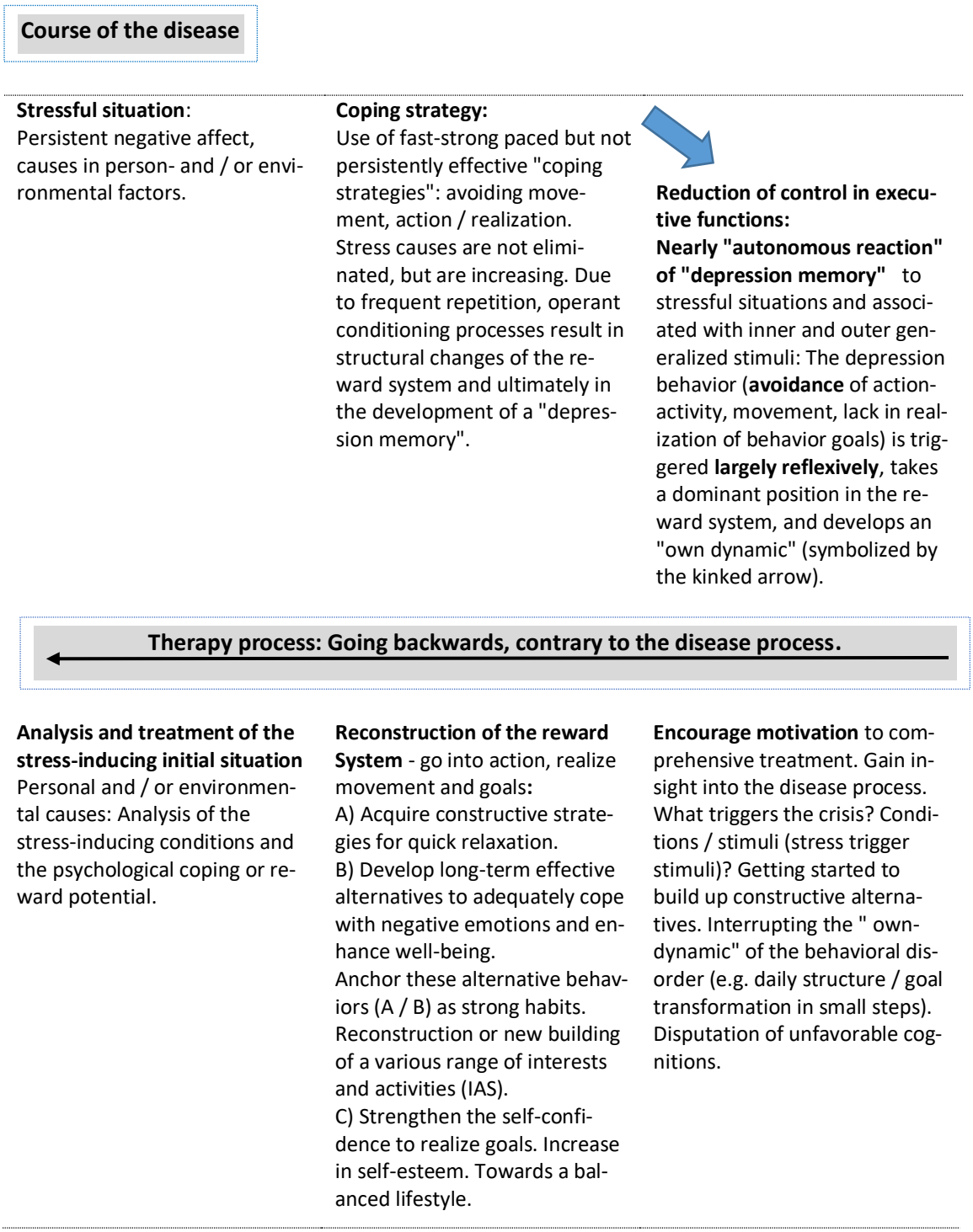

Fig. 5: Relationship of course of illness / treatment process - going back the way.

3.2. Realize therapeutic goals - reduce psychological and physiological resistors

The realization of important behavior projects could develop into an independent scientific topic. You have made a firm resolution to do more sport, but you still sit in front of the TV instead of jogging. People often do not achieve their goals. Wanting to do something alone is not enough to make your goals a reality.

Thürmer et al. (2015) postulate that to overcome one's own laziness, one must also plan when, where, and how one wants to achieve goals: "When I open the door to my apartment on Friday evening, I immediately put on my running shoes and go for a run." If-then plans seem to have very similar

advantages to habits and are a great help in implementation." (Thurn & Schlicht, 2012; Grant Halvorson, 2014; Thürmer, Wieber & Gollwitzer, 2015; Wieber, Thürmer & Gollwitzer, 2015; Thürmer, Wieber & Gollwitzer, 2016).
The sufficient training / practice of disease-incompatible alternatives, the initiation of movement, action-activity and the associated positive experiences open the opportunity to maintain an inner psychological balance, coping of problem situations and to increase overall well-being. Other reward-effective behaviors that have existed before (to reactivate now) and new developed alternatives must displace the dysfunctional behavior from the dominant position in the reward system (see Figure 6).

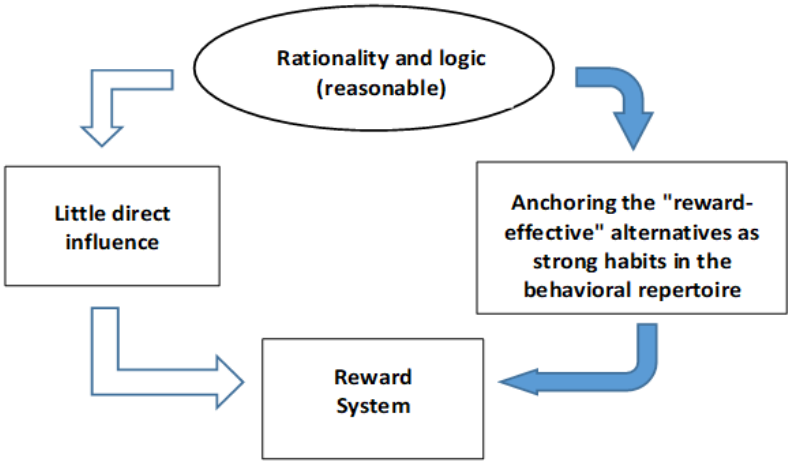

Fig. 6: Establishment of reward-effective alternatives to the reconstruction of the deeper brain regions of the reward system - symbolic illustration.

It is plausible **that frequent repetition and regularity are prerequisites for superseding dominant dysfunctional behaviors** and firmly anchoring alternatives in the reward system. The way out of depression and dependency means to regain interest and enjoyment on many other aspects of life, and to move **from the cognitive level to goal-oriented action**. Individual inclinations and personal needs must be considered to discover and build up new reward-effective behavior. Hautzinger & Wolf (2012) investigated the effectiveness of sport on mental (self-efficacy, distraction of thoughts), social (social support) and biological factors (monoamines, cortisol levels, neurogenesis, immunological processes) in people with depression. The result of this empirical study showed that sport had a positive effect. However, the effect size and influencing factors have not yet been sufficiently clarified. Moderate training seems to produce better results than too intensive training. Grimm & Krämer (2014) found that people with depression could be divided into four groups (clusters) based on self-assessment scales regarding their motivation, intentions, and attitudes towards sport: no intention to exercise (1), medium intention (2), high intention strength, lack of implementation (3), strong intentions and successful implementation (4). According to Fuchs and Schlicht (2012), **both the positive effects of sport on psychological well-being in general and on depression (Mead et al., 2009, Rethorst, 2009) are sufficiently confirmed**. In addition, cognitive treatment outcomes were significantly improved when combined with exercise **or other activities such as increasing social skills** (De Jong et al., 1980; Cuijpers et al., 2010).

In the light of a disease-related restriction of action-activity and movement, proper attention must be given to physical "fitness" so that anticipated stress in e.g. work can be managed (for example, following therapies). The dangers of a renewed excessive demands, "felt completely exhausted after the first few days in the workplace, etc.", is therefore counteract early. More often, sufferers mistakenly attribute unexpected states of fatigue to psychological-motivational reasons ("was not the right decision, after all") and not a lack of physical performance.
The often delayed or unsuccessful occurrence of desired behavioral changes is an essential component of behavioral disorders that are influenced by a disturbed reward system. Steel (2011) even sees a latent conflict between the prefrontal cortex, the seat of voluntary decisions, and the limbic system,

the seat of pleasure, fear, quick gratification, and excitement. In this sense, a behavioral disorder would mean that the limbic system has become dominant in phases or chronically. The dominance of harmful behaviors in the reward system impairs self-esteem and prevents the necessary behavioral changes to overcome psychological impairments and adequately improve the life situation (see Fig. 7).

Fig. 7: Overcoming psychological and physiological resistance. (NRW Sport).

Test results on procrastination indicate that it is not crucial to improve the feasibility of goals, first to change attitudes towards the goals set and to expect that this will result in an approximated automatic put into practice of the desired behavior. But the other way around: A realization of the behavioral change in small steps and the associated first (maybe small) sense of achievement leads to a change in attitude ("is even fun, not so bad") and increased self-confidence arises to achieve the set goal. As a result, positive thinking and self-esteem develop through successful action. While the other way, "if I think long enough, the behavior changes," showing fewer positive results. So, success is more in the sense of bottom-up than top-down (Rist et al., 2006). Therapeutic efforts are therefore aimed at **developing concrete plans, realization of the desired behavior, structuring the daily routine in a meaningful way**, **creating weekly plans, and providing balance and relaxation on a daily basis**. Here, **"highlights" are to be planned**, so that the "gray everyday life" does not find its way into the picture. One in this balanced lifestyle is the best guarantee for reducing the risk of relapse. The best possible foresight on the expected level of stress and your own regulatory potential ("balancing"), is the basis for on the one hand to manage the obligations and on the other hand to make an interesting varied day and week design.

In a first-class summer weather, a patient responded indignantly / ironically to an "inappropriate" question from the therapist: the last thing she would come up with now is the idea of going to a swimming pool.

The “reward ability” of a particularly **valuable behavior for health and stability** are **often not immediately recognized** but only after a phase of learning, training, and increasing competences. Depending on the level of difficulty, considerable frustrations must first be overcome in this process so that the desired positive effect of the new or reactivated behavior on the emotional state sets in only gradually - but then particularly effectively and sustained. The anchoring and sufficiently high establishment of the behavior in the reward system often requires a considerable endurance, for which the psychological ill person is not yet capable and **therefore requires** a considerable amount of **social, psychotherapeutic, and medical assistance**. At this stage of the therapy process, there is often a lack of therapeutic concepts and sufficient support to bring about long-term effective behavioral change. As the resistance experienced gradually gives way to the rewarding ability of the new alternatives, the establishing of

desired behavior seems to be successful. A good symbolic illustration is the pyramid of interests and activities, which includes behaviors from basic activities to highlights.

Fig. 8: Pyramid of Alternatives.

Factors of motivation, the **joy of movement**, the **creation of positive experiences,** perhaps including moderate competitions, with a particularly **high positive emotion and relaxation effect** - sport / game / excitement - in pairs or in small groups (e.g. "tennis" with a softball), where the performance aspect initially has little or no significance, have so far been neglected too much. Most of the time a ball in a game does funny things and laughter comes automatically. Differentiation and diversity also have the effect of a renewed too strong practice of a certain behavior, not to get from one "extreme" to another.

4. Extracts from an empirical study for support the theoretical approach and therapeutic measures

In a first study on the construct of the " Interests and Activities Spectrum " (IAS) (Bachmann, M. & Bachmann A. A., 2023a, b; 2024a), the thesis was examined that **under the influence of a dysfunctional reward system**, the **spectrum of interests and activities narrows** (narrowing effect). In addition, correlations with the IAS and depressive behavioral disorders as well as other parameters such as life satisfaction and the different categories of the IAS. The interest an activity questioner (Bachmann, M. & Bachmann, A. A., 2024b) included 176. The reinforcing items divided into 10 categories: (1) Social contacts, competence, (2) Exercise, fitness, (3) Mental activity, (4) Showing feelings, (5) Recreation, (6) Experience adventure, (07) Culture enjoyment, (8) Hobby, creativity, (9) Media use and (10) Basic activities. Using two 5-point scales, both the current state (is status) of interests and activities ("How often have you engaged in these interests/activities in the past year?") and the desire for change (should be status) ("Do you have a desire to pursue these interests/activities more frequently?") of the 176 items are determined (Table 1). The categories confirmed by "experts" (psychologists in training to become Behavior Psychotherapists) and the reward values (whether and to what extent an item can positively influence the psychological state) assessed by them were considered (seven-point scale - Table 2).

Table 1. *Scaling IAS- Questionnaire* ***Patient Version*** *(Bachmann, M. & Bachmann, A. A., 2024b).*

Interests / Activities	**How often have you engaged in these interests/activities in the past year? (Please tick on the number)**					**Do you have a desire to pursue these interests/activities more frequently? (Please tick on the number)**				
	not at all				**to a large extent**	**not at all**				**to a large extent**
1. Be on the beach	1	2	3	4	5	1	2	3	4	5
2. Share your experience with others	1	2	3	4	5	1	2	3	4	5
Continuing until item 176	1	2	3	4	5	1	2	3	4	5

Table 2. *Scaling IAS-Questionnaire* ***Expert Version*** *(Bachmann, A. A., 2021).*

Interests / Activities	**Classify into categories** Please enter here the number(s) 1-14	**To positively change the psychological state: To what extent are the listed Interests / activities suitable for this purpose?** (Please mark with a cross on the number)						
		not at all						**to a large extent**
1. Be on the beach		1	2	3	4	5	6	7
2. Share your experience with others		1	2	3	4	5	6	7
Continuing until item 88 (split half)		1	2	3	4	5	6	7

In Table 3 are the reward values ordered in the 10 categories (with number of items) shown. The Category 04 Showing feelings" has the highest values, media use the lowest.

Table 3. IAS *categories and reward averages rank order, in Open Access (Bachmann, M. & Bachmann, A. A., 2024b).*

Category	**Reward Value (M)**	**Numbers of Items**
04 Showing feelings	5.38	8
05 Recreation	5.19	22
06 Experience adventure	5.04	11
02 Exercise, fitness	4.86	21
07 Culture enjoyment	4.77	10
01 Social contacts, competence	4.68	39
08 Hobby, creative	4.30	20
10 Basic activities	3.92	16
03 Intellectual activity	3.79	22
09 Media use	3.46	7

Despite the rather low levels of syndrome in the addiction groups and the **mentally ill in the test procedure (ISR)**, significant negative correlations were found with the range of (**IAS**) interests and activities spectrum (according to Pearson, 2-sided tests; N=238-239). This means that the IAS values drop, i.e. a narrowing of the range of interests and activities is to be expected when a mental disorder (e.g. depression) tends to increase. However, no causal relationships can be concluded from correlations, which are reserved for experimental study conditions. The "IAS total value" correlated significantly

negatively with the "depression scale" with a medium effect at r(236) = -.253, p ≤ .001. These results indicate that depression is associated with a narrowing of the range of interests and activities.
In addition, there were significant negative correlations ("weak effect") with the "additional scale" at r(237) = -.143, p ≤ .05 and the "total burden" at r(237) = -.141, p ≤ .05. The narrowing of the range of **interests and activities (IAS)** could be further specified using the study, **i.e. which of the 10 categories identified were particularly affected**.

At the **category level of IAS**, the following significant **correlations** (*p ≤ .05; **p ≤ .01; ***p ≤ .001) can be found with the **ISR-Test** diagnostic**:**

- **Depression**: 01 Social contacts, competence -.245***, 02 Physical exercise – .216***, 03 Mental activity -.171**, 04 Showing feelings -.249***, 05 Relaxation -.177**, 06 Experience, adventure -.276***, 07 Experiencing culture, enjoyment -.313***.
- **Anxiety disorder**: 02 Physical exercise -.153*, 06 Experience, adventure -.173**, 07 Experiencing culture, enjoyment -.194**.
- **Obsessive compulsive disorder**: 04 Showing feelings -1.63*, 06 Experience, adventure -.148*, 07 Experiencing culture, enjoyment -.175**.
- **Additional scale**: 01 Social contacts, competence -,200**, 04 Showing feelings -,211***, 06 Experience, adventure -,182**, 07 Experiencing culture, enjoyment -,234***. • Total burden: 01 Social contacts, competence -,158*, 04 Showing feelings -,198**, 06 Experience, adventure -,199**, 07 Experiencing culture, enjoyment -,233***.

4.1 Next scientific projects

To further verify the hypotheses regarding the **narrowing of the range of interests and activities because of reward system dysfunction**, studies are planned with the IAS that include **more representative control persons** and **larger groups of people with depression and other behavioral disorders** (e.g. eating disorders, obsessive-compulsive disorders). Relationships with the IAS between life satisfaction, social competence and other variables must also be tested on larger samples. The aim is to improve the methods for implementing behavioral changes under conditions of dysfunctional reward systems to regain control over the brain's executive functions. To upgrade affect regulation and life balance, therapeutic measures require systematic selection and implementation of highly reward effective alternative interests and activities. Studies on therapeutic efficacy are also necessary.

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