Chapter 12
Changing Biased Interpretations in CBT: A Brief History and Overview

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Cogito, ergo sum – I think, therefore I am – is probably one of the most famous statements in philosophy (René Descartes; cf. Burns, 2001). Put simply, that we are thinking is evidence for the existence of the self. As psychologists, we might add that not only does thinking provide evidence for a self, but in fact thinking is one of the driving ingredients in *creating and shaping* the self, for example via processes such as attention, interpretation, and encoding into as well as retrieval from memory. This brings us firmly into the realm of clinical psychology, as these processes provide the fundamental targets for many cognitive-behavioral interventions. Given the focus of the present chapter and book, however, the "interpreting self" is of primary relevance.

In the following sections we would like to take the reader on a brief journey back in time, not quite so far back as Descartes, but far enough to provide a brief summary of the historical background of the development of cognitive-behavioral interventions. We will then provide an overview of how such cognitive-behavioral interventions may modify the process of interpreting the world – even if this was not always their original rationale – and thus set the scene for the case studies presented next in this book, targeting biased interpretational processes via techniques derived from Cognitive Behavior Therapy (CBT).

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12.1   A Brief Historical Background

It is difficult to pin down what exactly we should consider as "the" starting point of CBT, or even if there is any such thing; rather, where we stand today reflects a moment in a dynamic and ongoing developmental process that likely emerged organically from the scientific investigations and theories of the early twentieth century. However, a plausible proxy for a starting point is provided by the publications of the first theoretical and practical pioneers behind our current CBT techniques. Strictly chronologically, this should start with the "B" for behavior, for example from the works of Pavlov (1927), and later Skinner (1953), with both formulating important theoretical principles such as classical and operant conditioning, that is, the associative learning principles that are still highly relevant for today's interventions. Those who developed these ideas further and also transformed the theoretical B into more practical methods for changing psychopathology-relevant behaviors (i.e., Behavioral Therapy, BT) include Cover Jones (1924), Mowrer (1939), Watson and Rayner (1920), and Wolpe (1952). For example, via her "Little Peter" experiments, Mary Cover Jones provided an early example of behavioral treatment of a simple phobia (Cover Jones, 1924), and in a landmark theoretical paper, Mowrer provided a theory of the onset and maintenance of anxiety disorders such as phobias via classical and operant learning principles (Mowrer, 1939). The "C" of CBT, i.e., the cognitive component, arose from the "cognitive revolution" that took root in the 60s but further flourished during the 70s. The bringing in and integration of the cognitive component was in part fueled by the increasingly apparent shortcomings of BT: Despite its clear success in many cases, particularly in the context of anxiety disorders, BT was also characterized by a number of limitations. These limitations were not just restricted to treatment efficacy, but also more fundamental considerations that in fact relate back to the statement at the beginning of this chapter. That is, human beings think, interpret, believe, and imagine, but neither these cognitive processes themselves nor their interaction with behaviors seemed to be satisfactorily accounted for or targeted in BT. Hence, cognitive phenomena and processes entered psychotherapy. The publication of Beck's Cognitive Therapy and the Emotional Disorders (1976) and his Cognitive Therapy of Depression (Beck et al., 1979) were important milestones here (Woud, 2022; and for a recent special issue on Beck's contributions to the science and practice of CBT, see editorial Kazantzis, 2022) and laid the basic foundations for Cognitive Therapy (CT) (for an update and specification of Beck's model, see Beck & Haigh, 2014). Importantly, these seminal publications were very soon followed by clinical research trials, e.g., in the context of depression, indicating that CT was as effective as anti-depressants (Rush et al., 2005). At the same, several others were carrying out important and influential work on targeting the "C", such as Ellis (Rational-Emotive Therapy, 1962) and Meichenbaum (Cognitive-Behavioral-Modification, 1977). In the 80s, the "C" and "B" became fully fused into CBT, which then became firmly established. Both the effectiveness and the durability of CBT continued to receive growing support from randomized controlled trials, as did evidence also grew for its applicability across a

number of disorders (for reviews and meta-analyses, see e.g., Butler et al., 2006; Carpenter et al., 2018; Cuijpers et al., 2010; Gould et al., 1995; Hofmann et al., 2012; Hofmann & Smits, 2008; Kazantzis et al., 2018). Alongside this evidence of treatment efficacy, and in line with CBT's commitment to empiricism, an increasing number of studies also investigated the mechanisms underlying CBT's effects, resulting in the ongoing interplay between basic science and clinical implementation that we associate with CBT today (e.g., Blackwell & Heidenreich, 2021; Hofmann et al., 2013; Ingram, 2007).

12.2   CBT – The Basic Principles in a Nutshell

Cognition and behavior provide the core of CBT. In relation to cognitions, the main assumption is that an individual's response towards a certain situation is influenced by how the individual thinks about, appraises, and interprets the situation. The cognitive processing of the situation, not the situation itself, is the key determinant of the individual's behavioral response. Put differently, what the individual "does", their behavior, is (mostly) in line with the way the situation has been cognitively processed. To illustrate, if someone goes to a party and interprets the guests' faces as "smiling and welcoming", this will most likely result in the person staying at the party. In contrast, if they interpreted the same facial expressions as "smirking and patronizing" they may very well leave. However, there are of course more than cognitions and behavioral responses involved here, and CBT also emphasizes how these are tightly related to emotional and physiological states. With the present example, interpreting the faces in a negative and threatening manner may trigger e.g., anxiety, whereas a positive interpretation may trigger e.g., joy. In fact, the physiological response could be similar for either interpretations, e.g., in terms of arousal-related responses. However, in the end the situation's idiosyncratic processing determines the interpretation of these physiological phenomena. To illustrate, interpreting the faces positively and deciding to stay at the party may result in positive arousal such as increased heartbeat and sweating, reflecting the excitement and the expectation of having a great night out. Conversely, interpreting the faces negatively may result in a similar physiological reaction, but resulting from anxiety, and the individual themselves may then interpret this further negatively. Within CBT the interactions between cognitions, behavior, emotion, and physiology (see Fig. 12.1) are therefore given a central role in many disorder and treatment models, and it is assumed that these four components influence each other via ongoing and complex feedback loops. Further, individuals do not exist in isolation but rather within a broader environment and social context, and thus there are important interactions and feedback loops between, e.g., an individual's behavior and the response to their social environment.

Alongside this core role given to the interactions between internal and external processes, CBT has a few other notable key principles. Another principle is that psychological problems and disorders are not defined as categorically distinct
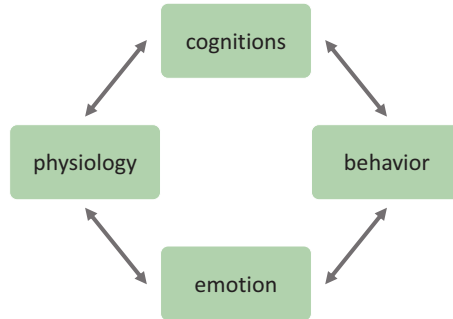
Fig. 12.1 The interaction between cognitions, behavior, emotion, and physiology

phenomena; instead, they are defined as phenomena on a continuum with normal functioning, that result from extreme or dysfunctional outputs of the systems outlined above. Whether or not the balance shifts towards and is maintained in a dysfunctional state depends on various factors, such as the individual itself, their vulnerabilities versus resources, and their present situation (see also "stress vulnerability models", e.g., Ingram & Luxton, 2005). The third principle in CBT is a focus on the here and now, which can be mostly attributed to the roots of BT and the idea that what should be tackled via therapeutic interventions are the observable symptoms. Consequently, CBT focuses on the individual's present, targeting processes that currently maintain rather than those thought to have originally caused the reported psychological problems. A final principle, which has been touched in an earlier section of this chapter already, is the idea that both therapy and theory should be the subject of an ongoing evaluation process, via systematic and rigorous research, optimally via a fusion of experimental, clinical, and multimodal approaches.

We would also like to present a few therapeutic principles of CBT. Some of the presented principles will be also shared by other therapeutic approaches, while some others are a logical consequence of the above-presented principles. To start with, a good working relationship needs to be established and should be regarded as an essential condition to make CBT successful. In this context, the term *collaborative empiricism* has been coined and implies that patients and therapists work as a scientific team: The patients are experts for their own problems, the therapists are experts for the adequate techniques to work on these problems. Together they e.g., test whether the patients' biased belief is correct and whether a certain technique is helpful to reduce that belief. To do so, therapists apply a way of "Socratic questioning" (for more detailed information, see e.g., Beck, 2020) that helps patients to reflect on and challenge their dysfunctional way of thinking. This, in turn, should widen the patients' perspective and trigger new insights, followed by more functional ways of thinking. These techniques, as well the therapists' attitude when applying these techniques, are often summarized via the umbrella term *guided discovery,* which represents another important principle of CBT. Further, CBT is problem-oriented, i.e., specific problems are identified, followed by goals of how to

target these problems. Finally, CBT is time-limited and, in case severe comorbidities or co-exiting personality disorders are absent, rather brief.

This last section will include an overview of the key principles regarding the conceptualization of CBT and its underlying theory. In line with the *here and now principle*, CBTs' therapeutic models have a stronger focus on hypotheses regarding maintenance than etiology. One of the most highly influential therapeutic models is the cognitive model by Beck (1976), which proposes three levels of cognitions to be relevant during information processing: core beliefs, dysfunctional assumptions, and negative automatic thoughts. Core beliefs, or schemas, are acquired early in life and influenced by childhood experiences. As such, they are deep and fundamental beliefs about oneself, other people, and the world, and serve as a first filter through which information is processed. They manifest themselves via absolute statements (e.g., "Others cannot be trusted"). Dysfunctional assumptions are described as conditional and rigid rules for living, and thus more specific than core beliefs. Typically, they take the form of "must" or "should" statements and can be culturally reinforced (e.g., "I must perform well when starting my new job otherwise the others will not respect me."). Like core beliefs, they are not always obvious and may be difficult to verbalize, and need to be inferred from e.g., behavioral patterns. Negative automatic thoughts refer to the ongoing stream of interpretations and appraisals of what is happening in the environment, noticeable once attention is paid to them. As their definition implies, negative automatic thoughts are activated involuntarily, especially if they are very habitual. However, they can become conscious and people can learn to become aware of them. Specific situations automatically trigger specific thoughts (e.g., "The new task my boss allocated to me is to make my life even harder at work."). Negative automatic thoughts are said to have a direct influence on emotional states and are generally experienced as not only plausible but statements of truth. This Beckian model therefore outlines three different levels at which biased interpretations may be identified or targeted. Not all CBT models make these distinctions, but they share a common premise: that cognitions play a key role in the maintenance of disorders, and thus changing these cognitions should lead to reductions in distress and impairment.

12.3 Techniques

CBT-based interventions share a common basic premise that psychological disorders reflect a dysfunctional, associative structure between cognitions, behaviors, emotions, and psychophysiology, maintained by dysfunctional cognitive (e.g., attention, interpretation, memory) and behavioral responses (e.g., avoidance, reinforcement). Most CBT-based interventions aim to identify and modify these interacting processes, i.e., intervene at the level of a disorder's maintaining factors, guided via the aforementioned key principles. In the following section, we will present a brief overview of some of the core techniques of CBT, focusing in particular on how they may modify biased cognitions. Interestingly, for many of these

techniques' identification and modification of dysfunctional cognitions may not be the core aim. However, by highlighting this aspect, we hope to focus on the central role of modifying such cognitions in CBT, and put the reader in a suitable frame of mind for the rest of this book.

12.4 Cognitive Restructuring

CBT aims to change how patients think. As such, cognitive restructuring can be considered one of classical CBT's most essential techniques, targeting core mechanisms that lie at the heart of its theoretical foundations. Cognitive restructuring is typically carried out as a stepwise process, which starts with the therapist helping patients to observe and note down the dysfunctional thoughts that occur in their daily lives. For example, during a therapy session, a patient might be invited to think back to a situation that elicited strong, negative emotions, and then report the thoughts that came to mind. The aim is to identify the "hot" cognitions, which according to Beck et al. (1979) are those most directly linked to the patients' most significant emotions and which play a critical causal role in the subsequent emotional and behavioral responses. Next, these hot cognitions are evaluated, for example, via the therapist asking a series of Socratic questions that help the patient evaluate their empirical and logical basis. The overarching goal of this phase is to widen and shift the patient's focus, and by doing so to help them start to re-evaluate their negative thoughts. As a result, the patient is guided to come up with more adaptive, for example more accurate, cognitions, which, in turn should have the potential to decrease the patient's negative emotional response during the described situation.

Within this general framework (i.e., first identification then modification of negative thoughts), there are many variations in how exactly the two steps are carried out. In a classical CBT-based approach, patients would be asked to keep a diary in which they record their feelings and cognitions in certain situations, rating the strength of their emotional responses and strength of their belief in each thought. These diary entries are then discussed during therapy, and may also be used to identify reoccurring themes or to identify specific cognitive biases, i.e., exaggerated thinking errors that trigger intensive negative emotional responses. Thought records such as the seven-column-thought-record (Greenberger & Padesky, 1995) or the dysfunctional thought record (Beck, 2020) can be used to help structure this process and initiate the modification. Patients will be asked to provide evidence for their negative thoughts, to develop alternative thoughts, and by doing so test whether the new way of thinking changes the original negative thoughts and feelings. To train and foster this new and more adaptive way of thinking patients are asked to continue completing these records at home or keep a positive data log, recoding all observations that are consistent with the new and functional way of thinking (Padesky, 1994). A huge variety of techniques have been developed to evaluate and challenge dysfunctional thoughts, for example, weighing pros and cons in combination with

their long- and short-term outcomes, identifying the worst outcome and potential coping strategies, trying to take the perspective of someone else in that situation, or using more experimental techniques such as role-play or imagery. In fact, the described procedures can be applied to all levels of cognitions, i.e., for negative automatic thoughts, dysfunctional assumptions, and core beliefs. At the beginning of the therapy, however, the focus will most likely be on working on specific thoughts and emotions in specific situations, i.e., mainly on negative automatic thoughts. But, in an advanced stage of therapy and in order to establish more long-lasting changes, both the patients' dysfunctional assumptions and core beliefs should be targeted as well. It is important to note that the purpose of cognitive restructuring is not just identifying specific cognitions and modifying them, but also to change patients' relationships with their automatic thoughts and socialize them into the cognitive model (see e.g., Beck et al., 1979). Via the process, they learn that their intense negative feelings are often the result of thoughts popping automatically into their mind, and that in fact these thoughts are often not statements of fact but rather reflections of their own beliefs and personal histories. This increased meta-cognitive understanding can be liberating for many patients and may enable them to start simply ignoring or dismissing their negative cognitions, as well as paving the way for more direct methods of testing them, such as the behavioral experiments to be discussed next.

12.5   Behavioral Experiments

As with cognitive restructuring, behavioral experiments aim to identify and modify biased cognitions. However, behavioral experiments go one step further – first, they directly test the biased cognitions rather than evaluating them verbally; second, they are also used to actively generate evidence to further corroborate the patients' new and more functional way of thinking. Behavioral experiments therefore have the potential to be a more powerful tool, especially in situations in which a patient reports a mismatch between cognitions and emotions: Patients may be aware of the partly irrational nature of their cognitions and theoretically able to endorse a more functional way of thinking (in fact, the diagnostic criteria for several disorders include the patient being aware of the irrational nature of their fears). However, patients may also report that their emotions do not develop in accordance with their new way of thinking, and the old, biased way of thinking "feels more true". Directly testing the cognitions via a behavioral experiment, which will often also involve experiencing new and functional emotions while executing a new behavior, can help to initiate emotional change and bridge the "logical" vs. "emotional" divide. Although behavioral experiments are not new, for example with Beck (e.g., Beck et al., 1979) mentioning the use of experiments to test out patients' beliefs, they have played an increasingly important role from the 80s and 90s onwards, such that they can now be seen as the core driver for cognitive change in most modern CBT.

According to Bennett-Levy et al. (2004), behavioral experiments can be observational versus active, and hypothesis-testing versus discovery-oriented. This leads to four types of behavioral experiments. In the first, patients observe and test a hypothesis, such as, via a survey, investigating other people's opinion about a certain topic (e.g., how they would react if they saw someone walking through town with large sweat patches under their arms). A second option is that patients observe a situation in a discovery-oriented way, i.e., to simply collect information rather than test a hypothesis. For example, the therapist could wet their armpits to pretend they are sweating a lot, and then walk through the city center. Here, the patients' task would be simply to observe what is happening and not happening. This could then be adapted for a third option, in which the patient could play the active role instead of the therapist and observe people's reactions. The fourth and final option is that the patients are active and test a specific hypothesis, for example their prediction of what will happen in a certain situation, e.g., that if they walk through the town with large sweat patches under their armpits, people will point and laugh, and they will be unable to cope. In anxiety disorders, behavioral experiments are also used to collect evidence for and test hypotheses about the role of patient's safety behaviors (Salkovskis, 1996). In accordance with CBT's empirical foundation, each phase of a behavioral experiment (i.e., planning, execution, and reflection) is often accompanied by record-keeping and ratings, for example noting what the patient's initial prediction is, how plausible this prediction is before and after the behavioral experiment, what the outcome is and what the patient learned from it, and so on.

Behavioral experiments are sometimes combined with cognitive restructuring, e.g., beforehand to bring the patient to the point where they can see the logic of conducting an experiment, or afterwards to consolidate the learning. However, behavioral experiments can also sometimes happen spontaneously, for example when something happens in a session that can be easily translated into a behavioral experiment, and it makes sense to seize the moment. However, regardless of how the behavioral experiment is conducted, it is generally thought to be as very important that the prediction to be tested is clear and appropriately operationalized, and that, independent of the experiment's outcome, the patient will learn something when testing their predictions. As with cognitive restructuring, behavioral experiments are something that patients should ideally continue with outside of the therapy sessions.

12.6   Exposure

Behavioral experiments often include an element of exposure: To test a prediction about an anxiety-inducing situation, the patient must enter the situation and thus be "exposed" to it. However, we think it is useful to consider exposure separately in this chapter, and in fact, when viewed as a "behavior therapy" technique, the reader might wonder why it is relevant to a chapter about cognitions. With behavioral experiments – even if the crucial part involves exposure to a feared situation or

object – the main aim is explicitly to help patients to initiate a cognitive change. In contrast, from a traditional behaviorist view, the main aim of exposure was to help patients to endure and habituate to their fears, via repeated and systematic exposure to exactly those cues they fear and avoid (Craske et al., 2014). Within this behaviorist viewpoint, cognitions play no mechanistic role. However, this conceptualization of exposure has since changed, developing from a "fear habituation" approach to a "belief disconfirmation" approach as more evidence as to its mechanisms have been gathered (see Craske et al., 2014, p. 10). According to this more recent conceptualization, exposure should be tailored to the patient's most important idiosyncratic feared outcome, and expectation and operationalized such that the patients' biased expectation is maximally violated. Thus, while termed "exposure", the technique is closely aligned to behavioral experiments and cognitive restructuring as described above, in that a major aim is initiating cognitive change.

In CBT exposure can be carried out either in-vivo or via imagery (imaginal exposure). Generally, in-vivo exposure – that is, to the actual feared situation – would be preferred, but sometimes this is not possible (e.g., the object of exposure is a traumatic experience that happened in the past) and thus imaginal exposure is used. In recent years, exposure conducted via virtual reality has also become a possibility, expanding the scope of what is possible (see e.g., Lindner, 2021, for an overview). Virtual reality enables immersive computer simulations of the feared object or situation, rendering it possible to also expose patients to situations that are difficult to encounter or re-build in real life (e.g., when thinking of a PTSD patient who was traumatized during combat). Regardless of how exactly the exposure is implemented, in vivo, via imagery, or virtual reality, there are also different ways in which it can be conducted, for example with or without a stepwise fear hierarchy (graded exposure vs. flooding) or can be combined with relaxation exercises (systematic desensitization).

Based on recent developments in research on exposure and its underlying effects, there are various recommendations of how to foster and consolidate the intended cognitive change (see e.g., Craske et al., 2018; Pittig et al., 2016, 2019). For example, exposure sessions are continued for the duration needed to most effectively violate the patients' expectations – put differently, the session's length is not determined by the level of fear reduction. Further, any type of (evaluating) cognitive technique is applied after the actual exposure has been completed. Typical questions include asking the patients what they learned regarding the non-occurrence of the feared expectation, and identify discrepancies between what was expected and what actually happened.

12.7   Mental Imagery-Based Techniques

The use of mental imagery has a long history in CBT, with techniques emerging from both the cognitive and behavioral strands of its development (e.g., Blackwell, 2021), and there are several ways in which mental imagery can be used to change

cognitions (for an overview of the role of imagery in biased interpretational pro-
cessing, see Chap. 6 by Blackwell). In his early works, Beck (e.g., Beck, 1976)
already emphasized the role of mental images in psychopathology. For example, he
suggested that mental images, memories, or dreams may contain important infor-
mation on how patients interpret themselves, others, and the world, and also sug-
gested manipulations of mental imagery as a method to change beliefs. Importantly,
from the perspective of this chapter, mental images do not occur in isolation and are
often accompanied by other cognitive responses – such as interpretations (see e.g.,
Blackwell, 2020). In fact, for some disorders the interpretation of mental imagery is
seen as highly important, for example in PTSD, where maladaptive interpretations
of recurring intrusive memories (e.g., "The fact that I have these memories means I
am going mad") are given a central role in some cognitive models (e.g., Ehlers &
Clark, 2000), fueling dysfunctional coping strategies that contribute to maintaining
distress.

In terms of imagery-based techniques, Holmes et al. (2007) differentiate between
two broad categories: Techniques that involve directly working on the mental image
versus those that are indirect. In turn, both kinds of techniques can be used either to
reduce negative imagery or enhance positive imagery. Of direct techniques, the one
with the clearest relevance to changing cognitions is imagery rescripting (Arntz,
2012). Imagery rescripting, which can be applied to memories, future-oriented
imagery, or even deliberately generated metaphorical imagery (Butler et al., 2010),
aims to integrate new information into a distressing image and thus change the
meaning at an emotional level. As mentioned above, imagery can also be used to
conduct exposure (e.g., to memories of a traumatic event in PTSD, see e.g., Foa
et al., 2007). During imaginal exposure, patients are asked to deliberately evoke a
highly distressing image or to listen to imagined, highly distressing situations, and
by doing so expose themselves to all negative emotions and cognitions that come
along. As with exposure more generally, as discussed above, imaginal exposure can
be explained (as it was originally) without any mention of cognitions or cognitive
change. However, most modern conceptualizations would understand imaginal
exposure as leading to changes in processes such as how a memory or situation is
interpreted. In contrast, indirect techniques do not engage with the imagery but
instead target aspects of its properties, such as e.g., the dysfunctional emotional and
cognitive responses to it. In the context of reducing negative mental imagery, meta-
cognitive imagery-based interventions often aim to change how patients relate to
the mental image by learning to appraise the mental image as "being just an image" –
an image that comes and goes, just like other images. This image thus does not need
special attention and is not representative of reality (e.g., Holmes et al., 2019).

12.8 Behavioral Activation and Activity Scheduling

Activity scheduling and behavioral activation, whether carried out as treatments in their own right or as sub-parts of broader CBT packages, are core "behavioral" approaches in the context of depression, and thus, as with exposure, may seem odd inclusions in a chapter on changing cognitions. And as with exposure, behavioral activation can be conceptualized from a purely behaviorist perspective without invoking cognitions: By increasing how much they engage in activities that are positively reinforced, the patient receives more positive reinforcement in daily life, improving their mood and also strengthening the link between the behavior and reinforcement. However, behavioral activation can also be viewed from a more cognitive perspective (e.g., Beck et al., 1979; Bennett-Levy et al., 2004). From this angle, there may be biased cognitions that contribute to and maintain a patient's inactivity. In the context of depression, for example, a patient's inactivity may be fueled by a cognition such as "I don't enjoy anything anyway so there's no point". Keeping an activity record in which they also record enjoyment and mastery can thus be used as an experiment to test out this cognition, for example highlighting how their enjoyment fluctuates and is not at a constant "zero", or to test the idea that lack of enjoyment means that an activity was therefore not worthwhile (see e.g., Beck et al., 1979). Initiating and fostering a cognitive change can therefore become a central aim of behavioral activation.

A common technique in the context of behavioral activation is monitoring daily activities via a weekly activity schedule. Using such a 7-day schedule, patients are asked to complete for each day and every hour of that day what they did, and the patients' entries are then reviewed during the session. Initially, monitoring is an important aim here, i.e., obtaining a better understanding of what the patients' activities are, and to identify activities that give the patients at least some experience of mastery and pleasure or relief from their negative thoughts. Importantly, however, such a weekly schedule can be also used to plan changes in the patients' future activities, which, in turn, should also initiate cognitive changes. That is, enhancing the patients' level of activity will also lead a to change in the patients' negative cognitions, and via pleasure and achievement ratings, such changes can be monitored and evaluated.

12.9 Cognitive Training Approaches

A number of more recent developments include the use of simple training approaches to change cognitions. For example, several methods involving repeated practice of memory retrieval have been developed and tested (Hitchcock et al., 2017). To illustrate, during Competitive Memory Training (COMET; Korrelboom et al., 2009) patients train to generate vivid, personal memories of themselves in which they are the central figure, and by doing so train to construct more positive, stronger mental

representations of themselves. Although not conceptualized as a method to change interpretations, it could be hypothesized that COMET would have such an effect by increasing the accessibility of positive memories that might be drawn on when patients encounter ambiguous self-relevant situations.

The area of cognitive training most relevant for changing interpretations comes from the Cognitive Bias Modification (CBM) literature (cf. Koster et al., 2009; Woud & Becker, 2014). CBM involves repeated and systematic computer training targeting cognitive processing biases in e.g., attention, appraisal, or interpretation, and within a treatment context, the aim is to reduce such biases (e.g., Lazarov et al., 2018; Salemink et al., 2015; Vrijsen et al., 2019; Woud et al., 2021; and for an overview of how to manipulate interpretation biases, see Chap. 11 by Salemink et al.). The most commonly used CBM paradigms used to modify interpretations biases involve the presentation of ambiguous scenarios that are then resolved positively. Being repeatedly constrained to resolve the ambiguous scenarios positively during the training is thought to lead to a more positive interpretation style that patients will then apply to ambiguous situations encountered in daily life. In most forms of CBM-I participants are encouraged to imagine themselves in the training scenarios to enhance emotional processing (e.g., Mathews & Mackintosh, 2000), and in some clinical applications, this imagery component has been particularly emphasized and expanded upon (e.g., Blackwell et al., 2015; Hirsch et al., 2021).

12.10 "Third Wave" Approaches

The past 20 years have seen an increase in what has been termed a "third wave" of CBT approaches (Hayes, 2004), for example including mindfulness-based cognitive therapy, acceptance and commitment therapy (ACT), and compassion-focused approaches. Some of these explicitly target cognitions, for example, compassion-focused approaches that include imagery and other experiential techniques to foster more compassionate beliefs about oneself. Others, such as mindfulness-based approaches and ACT, may not have changes in interpretations as their primary focus, or even part of their conceptualization, but can be viewed within a cognitive framework as changing meta-cognitive interpretations. For example, via the act of observing their thoughts mindfully and not being "sucked in" to unhelpful patterns of responding, patients learn to interpret their thoughts as passing events rather than statements of truth that must be acted upon. Hence, techniques developed within the context of third-wave CBT can also be incorporated into more classical cognitively focused approaches. The most recent developments in this field emphasize the processes of change using an idiographic and network-analytic, functional, and contextual approach. This stands in contrast to a syndromal, disease-entity focused, nomothetic, and linear approach (Hayes & Hofmann, 2021; Hofmann & Hayes, 2019). This movement introduces a fundamental shift in clinical science and is likely to introduce new and improved methods for studying treatment change (Hofmann, Curtiss, & Hayes, 2020).

12.11   Summary and Outlook

In this chapter we presented a brief overview of CBT-based techniques that are commonly used, or can be used, to identify and modify biased interpretational processes. Given CBT's empirical nature and evidence-based perspective, these techniques are under continuous scientific evaluation using both rigorous experimental and clinical studies (for a related discussion about the interplay of scientific research and clinical practice, see Chap. 1 by Holmes). For example, the section on exposure, with its shift from habituation to cognitions, noted how scientific progress can affect clinical techniques, and this in turn offers new input for research on exposure. To illustrate, in the context of fear conditioning and extinction learning, researchers have started to explore the role of cognitive processes such as the effects of verbal instruction on CS-US contingencies (cf. Mertens et al., 2018) or by adding imagery-based techniques (e.g., Hendrikx et al., 2021; Krypotos et al., 2020; and see for review Mertens et al., 2020). Further, during fear conditioning, stimuli may in fact become ambiguous stimuli, resulting in increased fear in anxiety-prone individuals, and this may have consequences for exposure-based techniques (for a related discussion about the role of interpretational processing during fear conditioning, see Chap. 7 by Scheveneels and Boddez). As another example, taken from the section on cognitive training approaches, CBM techniques, which were developed from experimental psychopathology research, may offer promising new therapeutic add-ons. For example, CBM training targeting biased interpretations and appraisals (e.g., de Kleine et al., 2019; Salemink et al., 2015; Woud et al., 2021) may offer fruitful treatment adjuncts that could facilitate or further reinforce the cognitive change established during therapy. Specifically, "take home trainings" could be developed that patients do as computerized homework, helping to foster a generalization and transfer of the learning into the patient's everyday life.

   To conclude, there is an ongoing drive for continued improvements of CBT and CBT-based techniques to ease the suffering of our patients more efficiently, both in the short and long term (for a recent special issue on future directions in CBT, see editorial Hofmann, 2021). Interventions involving initiating and maintaining cognitive change, via systematically modifying patients' biased way of thinking, provide a promising and robust route to do so. In the next section, you will find five case studies using various techniques applied to modify biased cognitive processing, namely in the context of posttraumatic stress disorder (Chap. 13 by Schnyder), depression (Chap. 14 by Moulds), obsessive-compulsive disorder (Chap. 15 by Purdon), social anxiety disorder (Chap. 16 by Daniel and Teachman), and panic disorder (Chap. 17 by Becker), and we hope that the present chapter provided you with a good starting point for reading them.

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