



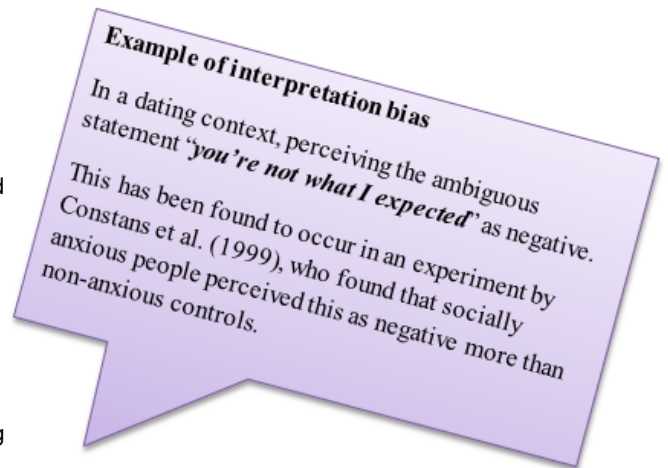
respond to probes which occur in the place of negative stimuli provides an index for which selective attention can be measured.

These types of assessment techniques have repeatedly demonstrated attention bias to negative stimuli in clinical and nonclinical anxiety (Cisler and Kosler, 2010) as well as depression (Baert et al., 2010).

## Interpretation bias

Interpretation bias is simply the process of interpreting ambiguity in a negative light. It occurs when there are competing processing options and one of these has to be selected. One option will usually be threat-related and the other will usually be non-threat related. To interpret the situation, one response will be inhibited and the dominant response will take over and use attention resources.

In anxious individuals, threat-related interpretations usually dominate and so use up most of the processing resources (Richards, 2004). Anxious individuals will also tend to interpret ambiguous emotional stimuli as being threatening or negative and perceive emotionally neutral acts of others as being done with negative intent. Interpretation bias has also been associated with a depressive disposition (Ree et al., 2006).



## Types of Cognitive Bias Modification

### CBM-A

This type of Cognitive Bias Modification is aimed at reducing selective attention for negative information (i.e. attention bias). This is done by repeatedly exposing participants to stimuli that encourages them to look away from threatening information and instead pay attention to neutral or positive information.

### Methods of CBM-A

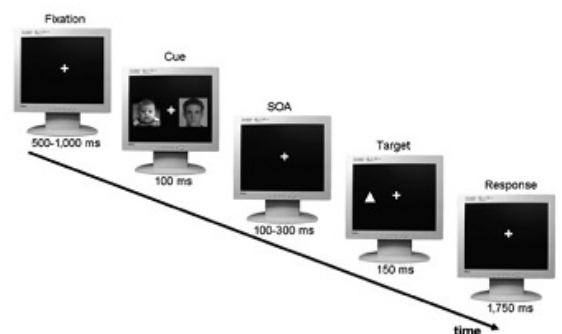
CBM-A methods typically incorporate tests of attention bias, but modify these so that instead of assessing the bias, they are training attention away from the biased stimuli and directing participants towards the opposing stimuli.

#### Modified version of dot-probe task

Developed by Mathews & McLeod (2002), this is the most common CBM-A method. This type of CBM-A can be attend-negative training or attend-positive training.

In attend-negative training, probes appear in the locus of negative stimuli whilst in avoid-negative training these probes appear in the locus of neutral stimuli. The probes can either be words or faces.

In their study, Mathews and McLeod found that those in the attend-negative training condition reacted more quickly to the probes which were in the locus of negative words. This indicates that they are paying more attention to negative stimuli than positive stimuli. This is in contrast with the finding that those in the avoid-negative training condition responded more slowly to probes in the locus of negative stimuli. This indicates that they have been trained to avoid focusing attention on negative stimuli.



#### Visual search task

Dandeneau and Baldwin (2004) developed a training version of the visual search task as a method of CBM-A. This is where the individual has to search for a single, positive stimuli within a matrix of negative distractor stimuli. Evidence suggests that this task reduces attentional bias for negative stimuli.

### CBM-I

This type of Cognitive Bias Modification targets interpretation bias. Participants are encouraged to resolve emotionally ambiguous information in a more positive way.

## Methods of CBM-I

### Mathews and Mackintosh scenario paradigm

#### Example statements

You are walking alone at night.

You hear footsteps approaching  
you from behind.

You realise...

*you might be attacked*

*it was your friend approaching*

The most commonly used CBM-I task, where participants are presented with three-line ambiguous scenarios which remain that way until the last word. The final word tends to be fragmented so that the individual has to resolve the ambiguity by deciding what it should be. Changes in interpretation are then measured with a recognition task, where new scenarios are presented and these also remain ambiguous. After reading these scenarios, participants must then rate the similarity of four sentences to the original scenario. One will be a positive representation, another will be a negative representation of the original scenario. The other two sentences are not possible interpretations of the original scenario, and are in place to ensure a change in interpretation has taken place, as opposed to the CBM-I having induced a response bias.

Those who initially experience scenarios ending in a non-threatening (positive/neutral) way are thus more likely to select the positive representation as being accurate. On the other hand, those who are trained in the scenarios ending in a threatening (negative) way will select the negative

representations more often.

# Cognitive Bias Modification vs. Cognitive Behaviour Therapy

Cognitive Behaviour Therapy (CBT) is one of the most commonly used interventions for disorders like anxiety and depression. It aims to encourage patients to gain insight into their thoughts and identify where these come from and what effect they have. It also attempt to address what unhelpful thoughts are so that people can recognise these and challenge them to reduce their influence on their emotions (Lang, Moulds and Holmes, 2009).

In contrast, CBM is not designed to provide this insight into thinking processes and it is also not aimed at altering the way in which individuals respond to these thoughts. Instead, it aims to alter the underlying cognitive processes which give rise to these thoughts (Macleod and Mathews, 2012).

Koster et al. (2009) identify 2 main features of CBM which differ from CBT:

- 1) CBM procedures directly change one particular bias which is linked to the formation of disorders, such as anxiety, which are regarded as occurring before conscious thought
- 2) CBM procedures do not rely on insight and targeted biases do not need to be accessed via introspection

## Key terms

**Cognitive Bias** = a pattern of illogical judgment in information processing

**Cognitive Bias Modification (CBM)** = manipulation of a cognitive bias using repeated exposure to contingencies within tasks which place emphasis on the desired patterns of selectivity

**Attention bias** = a frequently research form of cognitive bias which involves attention being focused on one particular type of information

**Interpretation bias** = a frequently researched form of cognitive bias which involved a tendency to resolve ambiguity in one particular direction

**CBM-A** = the form of CBM which addresses attention bias, usually via visual search or dot probe tasks

**CBM-I** = the form of CBM which addresses interpretation bias, usually via the Mathews & Mackintosh scenario paradigm

## Key considerations

- 1) Methods of CBM can be used on both clinical and non-clinical populations
- 2) It has been used as an intervention for anxiety, depression and addiction due to its ability to retrain attention away from aversive, negative information
- 3) But CBM can work in to train the brain to **avoid** threat or to **attend** to it

It is typically seen to be useful for training individuals to avoid threat and worry because excessive attention to threat can be maladaptive and lead to onset of disorders like anxiety etc.

However, there may be instances where doing so is actually maladaptive and poses more of a threat; for instance in healthcare situations

## ONE TO WATCH

*Notebaert et al. (2014)*

These authors argue that information processing biases which are implicated in emotional disorders are actually adaptive when they are targeted at information which is actually warning of genuine danger (Ohman and Mineka, 2001). If these biases were not present, it is likely that an individual would struggle to correctly identify when they are under genuine threat, which will put them more at risk to harm.

In the context of an individual's health, lacking these biases may mean that the individual does not experience excessive worry, but also does not interpret a danger to their health and does not seek treatment. In this sense, having excessive processing bias may be adaptive to the individual. This led to the hypothesis that CBM could be used to train people to perceive apparent threats more often so that they would seek medical treatment.

In this paper, the authors use the example of sun damage to test their hypothesis. They used CBM-I in the form of a health campaign video to target participants willingness to engage in protecting their skin against sun damage. The expectation was that those trained in the negative interpretation condition would experience more worry and engage more in sun protection behaviours than those in the positive interpretation condition.

The findings did not reflect this expectation, and those in the positive condition reported more worry than those in the negative. However, level of worry was found to be correlated with engagement in sun protection behaviour which does support the theory that worry promotes adaptive behaviour in the presence of legitimate threat.

Despite their findings failure to confirm fully their hypothesis, this type of research is novel and future research may attempt to further explore the use of CBM in inducing worry in situations where this is of more adaptive benefit to individuals.

## History of CBM

Cognitive Bias Modification can be traced back to originating from attentional retraining. Attentional retraining is the retraining of automatic attentional processes. Originally used in clinical settings, used in conjunction with other traditional therapies, to help rehabilitate patients with brain injuries such as hemineglect, perseveration, and limited attention span. The development of personal computers in the 1980s and recreational use of computer games in the 1970s saw the rise of computer-based tasks to help with improving patients' attention as well as other aspects such as reasoning/abstraction, spatial analysis, and learning and memory (McCalla, 2006). The use of technology has also been adopted in the remediation of cognitive-linguistic disorders; McCalla (2006) reported that in 2006 73% of American rehabilitation centres dealing with patients with such conditions used Computer-Assisted Cognitive-Retraining (CACR) programmes.

## Cultural Connections



Although not considered a traditional cultural connection, it is the case that the development of computer based CBM tasks, and now more recently, downloadable apps (e.g. 'Anxiety Mint' App downloadable from iTunes or Android) have led from the massive advances made in technology over the past thirty years. Without the progression of personal, affordable computer devices, such as iPods and laptops, many of the online aspects of CBM would obviously be impossible. Considering one of the main advantages of this type of therapy is that it can be done in your own time rather than organizing therapy sessions, which can be costly and time consuming, having the technology and the scientific knowledge to develop cost effective tasks will help to reach more people who could benefit from CBM.

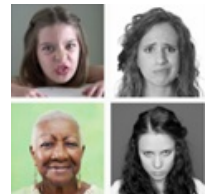
## Clinical Applications



Applied Cognitive Processing Therapies (ACPT), with or without accompanying medication or talk therapy, have had a very huge impact in clinical psychology in the last decade. The CBM was initially targeted at anxiety. However, there has been increasing interest in the development of computerized cognitive bias modification (CBM) techniques to modify negative interpretation biases (MacLeod, Koster, & Fox, 2009). Initial work demonstrates that effects of one type of CBM may generalize to other biases in anxiety (Amir, Bomyea, & Beard, 2010) and depression (Everaert, Koster, & Derakshan, 2012). Now, its use has been extended to depression, eating disorders and addiction.

## Anxiety

People with high trait anxiety or anxiety disorders display a pattern of information processing that favours emotionally negative stimuli (Bar-Haim, et al, 2007). This threat-related attentional bias is thought to play a prominent role in the etiology and maintenance of pathological anxiety (Renwick, Campbell, & Schmidt, 2013).



Findings across anxiety research have consistently shown that attentional bias to threat related stimuli can be successfully modified. Through manipulating attentional bias and decreasing attention to negative stimuli, anxiety is reduced and symptoms remit (Hakamata, et al. 2010)

## Depression

Four of seven participants demonstrated improvements in mood, bias and/or mental health after one week of CBM, with improvements in depressive symptoms maintained at follow-up (Blackwell, & Holmes, 2010).

## Older people

In older people, depressive symptoms are common, psychological adjustment to aging is complex, and associated chronic physical illness limits the use of antidepressants. The longer-term aim is to use CBM as a tool to positively modify the biases of people with emotional disorders and thus improve their mental health (Sefarty, et al. 2009).

## Eating Disorders

Clinicians and researchers have long emphasized the important role of fear and anxiety in the development and maintenance of eating disorders (Renwick, Campbell, & Schmidt, 2013).



Cognitive biases have an important place in both the theory and treatment of eating disorders (Williamson, et al. 1999). The relevance of threat-related attentional bias in Eating Disorders (ED) and considers how attentional bias modification offers an avenue for future research and the development of a new targeted treatment for EDs (Renwick, Campbell, & Schmidt, 2013).

## Addiction

Attentional bias in substance-dependent patients is the tendency to automatically direct attention to substance-related cues in the environment (Luijten, Field, & Franken, 2013). Cognitive bias modification therapy may help to overcome the dominant response tendency to approach alcohol-related stimuli (Wiers, et al, 2013).



However, the clinical efficacy of this treatment method for social anxiety disorder has yet to be established (Mobini, Reynolds, & Mackintosh, 2013). Specially, future research first needs to address the potential long-term clinical benefits of CBM-I training more rigorously (Telman, Holmes, & Lau, 2013).

Although, several studies suggest that CBM- I is a promising treatment for social anxiety this approach requires systematic evaluation through high quality clinical trials (Mobini, Reynolds, & Mackintosh, 2013).



# Gaps between theory and empirical evidence

## Critique 1: Small, pilot samples and lack of clinical trials

Much of the evidence into the efficacy of CBM and its ability to modify cognitive biases in clinical samples is dependent upon analogue samples and one session experiments. All of the current random controlled trials (RCTs) represent initial pilot studies, and not large-scale RCTs. This links to the fact that effect sizes from small studies are unreliable. So although much evidence from piloting studies suggests that CBM is effective, larger samples are needed and more clinical trials are also required to be able to confidently say that CBM is an effective treatment of anxiety disorders (Hakamata et al., 2010).

## Critique 2: Is CBM effective for anxious children?

It has been suggested that children have unique requirements and the task used for the CBM intervention should be based on their age and abilities (Monk et al., 2008). For instance, children can have a large variability in their reading abilities, so use of pictures as opposed to words is more useful.

Children younger than 7 struggle with the dot-probe task meaning there are a large number of errors made and this can mean the procedures are unreliable.

Older children between the ages of 8-12 potentially benefit more from shorter periods of training, fewer trials and many breaks between training blocks, but this may negatively impact the effects of anxiolytics. Older children and adolescents have been found to commit significantly more errors than adults on tasks used in CBM, and anxious children tend to produce even lower accuracy. This is especially true during the first few trials when their stress levels are still high.

Overall, it seems CBM may be appropriate for use with anxious children but the tasks should be modified to reflect the age and abilities of the children it is being used for, and close monitoring of accuracy rates as the training moves on is essential (Bar-haim, 2010).

## Critique 3: Is CBM applicable in real-world situations?

Many studies have found a lack of generalizability which suggests that CBM may not actually be changing cognition when an individual is in a real-world situation (Beard, 2011). This poses a difficulty in the CBM research, as there is no simple way of measuring attention and interpretation in real life environments. So although CBM is having an effect on the specific task domains in which it is found, more research is needed to ensure it can be confidently used as an intervention for emotional disorders.

## Wild uncritical claims

### "Cognitive-bias modification may put the psychiatrist's couch out of business"

This was the headline of an article in The Economist in 2011 which claimed that Cognitive Bias Modification was an effective alternative to traditional talking therapies. They explained that when addressing anxiety, depression and addiction, the way to go about it is "don't talk about it, just do it". However, the research into CBM is at least for the majority conducted alongside a traditional therapy such as counseling, CBT or a course of pharmaceuticals. Whilst it has been found that CBM plus a traditional therapy is more effective than the traditional therapy alone, there is little evidence to suggest that CBT is effective as a standalone therapy. Even Elaine Fox, who is one of the main researchers of the technique, admits that it is unlikely it ever will be used on its own as an intervention for these types of disorders.



## Practical Exercises

As has been indicated in previous sections, CBM has been adapted, and perhaps diluted, and is now available to anyone who wants to become more positive and optimistic. Downloadable tasks are available as well as websites full of information (if somewhat bias), and television programmes investigating the effects of CBM tasks.

BBC Horizons conducted a series of programmes called The Truth about Personality, with one episode particularly focusing on Cognitive Bias Modification. In the episode, Professor Elaine Fox (see below for details) is seen implementing the most up to date CBM techniques and tasks to alter the pessimistic mind of Michael Mosley. To watch a condensed version of the episode click the link here:

Additionally, there are a few websites devoted to promoting CBM and providing information on how it works and in what contexts. These websites include:

- <http://www.biasmodification.com/#CBM> (<http://www.biasmodification.com/#CBM%C2%A0>)
- <http://cognitivebiasmodification.com/> (<http://cognitivebiasmodification.com/>)
- <http://www.mcnallylab.com/research/cognitive-bias-modification/> (<http://www.mcnallylab.com/research/cognitive-bias-modification/>)
- <http://www.rainybrainsunnybrain.com/bbc-horizon/> (<http://www.rainybrainsunnybrain.com/bbc-horizon/>)

## Mobile phone Apps



Through the boom of smartphones and many people having access to laptops and tablets, it seems only fitting that CBM therapy techniques would manifest themselves into downloadable applications.

The image shown above is a screenshot of one of the regular example of a task in CBM. The basic concept is to train your brain to focus on the positive (happy face) image within the negative (angry faces). On iTunes and Android phones it is possible to spend a small fee of £1.49 to download 'Anxiety Mint', an app that has been developed to incorporate many of the tasks of CBM said to improve optimistic biases in people by simply regularly completing tasks. The creators of this app have also adapted this technique of cognitive bias modification to apparently help you loose weight and to help cut down and quite smoking.

HappyFace is another downloadable App from Google Play, example images given below ( for reviews & to download:

<https://play.google.com/store/apps/details?id=com.farmtherhinohorn.happyface> (<https://play.google.com/store/apps/details?id=com.farmtherhinohorn.happyface>)

### Points to Ponder

**Could improvements in 'happy face' recognition tasks, shown above, be due to a self-fulfilling prophecy? That is, do people who download CBM apps already believe that they will see improvements in their negative biases towards more optimistic biases rather than improvements being solely due to the tasks?**

## Try it yourself!

If you would like to try an online version of CBM-A for free, simply click the link below which will take you to an external website.

([http://baldwinlab.mcgill.ca/labmaterials/materials\\_16fa\\_c\\_80BBC.html](http://baldwinlab.mcgill.ca/labmaterials/materials_16fa_c_80BBC.html))  
([http://baldwinlab.mcgill.ca/labmaterials/materials\\_16fa\\_c\\_80BBC.html](http://baldwinlab.mcgill.ca/labmaterials/materials_16fa_c_80BBC.html))

## Rainy Brain, Sunny Brain



*"For optimists and pessimists alike, this fascinating book is a must read", Michael. J. Fox*

The book *Rainy Brain, Sunny Brain* was written by Elaine Fox. Elaine Fox is one of the most prominent researchers in the field of experimental psychology focusing on anxiety, fear, optimism, and the optimal mental health. She has many published articles in scientific journals such as *Nature*, *Science*, and *The Journal of Experimental Psychology*. Elaine Fox is currently a Research Professor in the Department of Experimental Psychology at the University of Oxford. Her research program includes combining cognitive psychology, neuro-imaging, and genetics.

*"Optimism, much like pessimism, is an intricate dance of genetics, life experiences, and specific biases in how each of us views and interprets the world around us", Elaine Fox, pg. vii*

The book describes the apparent two basic types of personality: 'sunny' and 'rainy'. Elaine Fox then goes on to investigate optimism, for example, why is it more elusive than optimism. It then goes onto investigate the genes that may determine our pessimistic or optimistic brain, moving towards brain plasticity and new techniques, including CBM, to reshape our brains. It may be worth pointing out that a book endorsed by a celebrity, such as Michael J Fox, perhaps hints at the commercialisation of the subject of CBM.

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### A brief review from The Guardian newspaper:

(webpage available here: <http://www.theguardian.com/books/2012/aug/10/steven-poole-non-fiction-roundup-reviews>)  
(<http://www.theguardian.com/books/2012/aug/10/steven-poole-non-fiction-roundup-reviews>)

**Rainy Brain, Sunny Brain** by Elaine Fox (Heinemann, £12.99)

Do you find your brain functions less well during a miserable wet summer? Me too, but the weather in this book's title is more metaphorical. The psychologist author collates research and anecdotes about the personality traits of optimism (sunny) and pessimism (rainy). Pessimism, she argues, comes from an overactive amygdala, the "fear brain"; optimism might be self-deluding, but it's evolutionarily "highly adaptive", and tends to make good things happen. As Franklin D Roosevelt didn't quite put it: "The ultimate obstacle to an optimistic life is fear itself, our emergency brain."

Fox constructs an elegant narrative from neuroimaging results, her clever psychology experiments, and the interaction of genetics and



environment. One can even learn, she promises, to be less pessimistic, with a dash of CBT, "cognitive bias modification", or meditation: so this falls into the well-populated genre of scientifically approved Stoicism. Heartwarmingly, it even seems that optimism can bring riches: Fox tells an anecdote of two Irish brothers, one of whom (the optimist) is now "a multimillionaire", and the other (less "sunny") "a schoolteacher in Dublin, struggling to pay his mortgage". What an idiot. But if everyone becomes an entrepreneur, who will educate the kids?

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Elaine Fox: Rainy Brain, Sunny Brain (<http://www.youtube.com/v/q5DQy9TaDUQ>)

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