- A cognitive schema can be defined as a mental representation of knowledge stored in the brain. A schema can be seen as a network of knowledge, beliefs, and expectations about particular aspects of the world.
- Schema processing is to a large extent automatic, i.e. processed with little attention. It involves information from two sources: Input from the sensory system (bottom-up processes) and information stored in memory (top-down processes), which is used to interpret the incoming information (pattern recognition, interpretation).

Brewer and Treyens (1981) Experiment on memory of objects in a room

Aim To investigate whether people's memory for objects in a room (an office) is influenced by existing schemas about what to expect in an office.

Procedure

- Participants were 30 university students, who arrived individually to the laboratory and were asked to wait in an office containing objects (e.g. desk, typewriter, coffee-pot, calendar). There were also other objects that did not conform to the office schema (a skull, a piece of bark, a pair of pliers).
- After waiting for some time, participants were taken out of the office and asked to write down everything they could remember from the room.

Results

- Most participants recalled the schematic objects (e.g. desk, typewriter).
- Some participants reported things that would be expected in a typical office but were not present in this one (e.g. telephone, books).
- Many participants also recalled the skull (unexpected object). The very unusual object resulted in better recall than predicted by schema theory.

Evaluation

- The study confirms schema theory (and reconstructive memory), but it was a controlled laboratory experiment so there are issues of artificiality.
- The study used deception (participants were not told about the real purpose of the experiment) but they were debriefed afterwards and not harmed. The study could not have been made without deception so it was justified.
- There is sample bias. University students were used as participants so it may be difficult to generalize the results.

Brewer, W.F. and Treyens, J.C. (1981) "Role of schemata in memory for places", *Cognitive Psychology*, 13, pp. 207-30.

Darley and Gross (1983) carried out a laboratory experiment on schema processing in the social world.

- In this laboratory experiment, the participants saw two videos of a girl. In video 1 a girl was playing in a poor environment; in video 2 a girl was playing in a rich environment. Then they saw a video of the girl in what could be an intelligence test.
- When the participants were asked to judge the future of the girls they all said that the "rich" girl would do well and the "poor" girl would do less well.
- The study demonstrates that participants probably used pre-stored schemas of what it means to be poor and rich and interpreted the ambiguous information accordingly. Participants processed information based on a few salient details to form an overall impression that may not necessarily be correct.

Possible ways in which schemas affect memory

- People tend to remember the meaning (gist) of something, not the actual wording.
- People use stored knowledge to make sense of incoming information. If the information is unclear or incomplete, they fill in the blanks or interpret using their schemas. This is called "reconstructive memory" and results in distortion.
- People tend to ignore information that is not in line with their schemas (aschematic information). This may lead to bias in information processing (e.g. in stereotyping where people ignore information that is not in line with their schema).
- People tend to focus on information that is in line with their schemas (schematic information). This may result in "confirmation bias".

Bartlett (1932) "The War of the Ghosts"

Aim To investigate whether people's memory for a story is affected by previous knowledge (schemas) and the extent to which memory is reconstructive.

Procedure Bartlett asked British participants to hear a story and reproduce it after a short time and then repeatedly over a period of months or years (serial reproduction). The story was an unfamiliar Native American legend called "The War of the Ghosts".

Results The participants remembered the main idea of the story (the gist) but they changed unfamiliar elements to make sense of the story by using terms more familiar to their own cultural expectations. The story remained a coherent whole although it was changed. It became noticeably shorter for each reproduction. Bartlett concluded that remembering is an active process. Memories are not copies of experience but rather "reconstructions".

Evaluation

- The results of the study confirm schema theory (and reconstructive memory), but it was performed in a laboratory and can be criticized for lack of ecological validity.
- Participants did not receive standardized instructions and some of the memory distortions may be due to participants' guessing (demand characteristics).
- In spite of these methodological limitations, the study is one of the most important in the study of memory.

Bartlett, F. (1932) *Remembering: A study in Experimental and Social Psychology*. Cambridge: Cambridge University Press.

Strengths of schema theory	Limitations of schema theory
■ Schema theory has proven extremely useful in explaining many cognitive processes (e.g. perception, memory, and reasoning). ■ Schema theory can be used to explain the reconstructive nature of memory, for example in eye witness testimony, stereotyping, gender identity (gender schema) and cultural differences (cultural schemas).	■ Cohen (1993) argued that: the concept of schema is too vague to be useful and it is not clear how schemas are acquired in the first place. ■ Schema theory may focus too much on the inaccuracies of memory but most of the time people remember accurately.

THEORY

THE THEORY OF REASONED ACTION (TRA) AND THE THEORY OF PLANNED BEHAVIOUR (TPB)

These two theories have been proposed to explain human decision-making in a variety of domains, not only health-related behaviour. However, they have been extensively applied in health psychology as well.

For an introduction to the TPB see "**2.1.3 Thinking and decision-making**" in "**Unit 2 Cognitive approach to behaviour**".

The TRA (Fishbein 1967) argues that future behaviours are best predicted by the presence of a behavioural intention, and that the behavioural intention is in turn predicted by two sets of beliefs—attitudes ("behavioural beliefs") and perceived social norms.

The TPB essentially was an extension of this framework that added one more dimension to it—perceived behavioural control (Ajzen 1985). This was to a large extent due to Bandura's work on self-efficacy at that time, which showed self-efficacy to be an important predictor of future behaviour.

In both these models behavioural intention is essentially a combination of a number of prior beliefs, this is why they are both **belief models**.

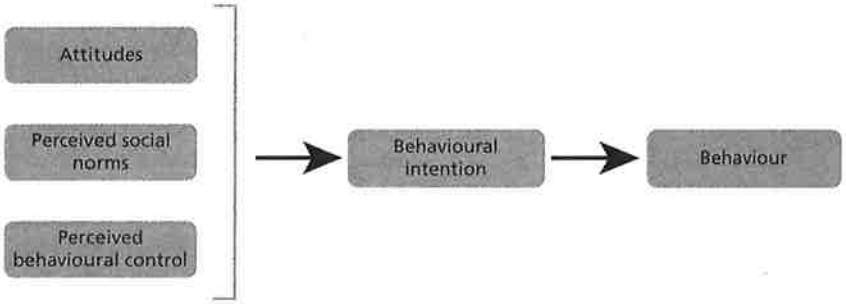

Figure 5.8 TPB factors affecting health behaviour

RESEARCH

Godin and Kok (1996)—predictive power of the TPB for health-related behaviours

Essential understanding

✪ *Across a range of health behaviours the TPB model provides good explanation (about one third) of the observed variation. Correlations are consistent with what is predicted by the model.*

Procedure and results

Godin and Kok (1996) carried out a systematic review of existing evidence for the efficacy of the TPB in explaining and predicting health-related behaviours. In a synthesis of 56 research studies they established the overall average correlations as:

- between intention and attitudes: 0.46
- between intention and perceived social norms: 0.34
- between intention and perceived behavioural control: 0.46
- between intention and behaviour: 0.46.

Collectively the first three variables explained 32% to 46.8% in behavioural intention (the lowest estimate was obtained in the domain of eating behaviours, the highest in oral hygiene behaviours).

Conclusion

The overall conclusion from the study was that the TPB could explain about one third of the observed variations in health-related behaviours. At the same time there was considerable dispersion of results depending on which health-related behaviour is predicted exactly.

RESEARCH **Loh and Kanai (2014)—neurological correlates of media multi-tasking**

Essential understanding

✪ *Low grey matter density in the anterior cingulated cortex (ACC) may be the physiological basis of being prone to induced media multi-tasking.*

Aim

To investigate the physiological correlates of media multi-tasking.

Method

Correlational study; variables were measured by a questionnaire and fMRI.

Participants

75 healthy adults.

Procedure

Participants went through fMRI scans of their brain and filled out a self-report measure of media multi-tasking.

Results

There was a correlation between reported multi-tasking and grey matter density in the ACC.

Explanation

The ACC is known to be involved in:

- cognitive control (for example, it is active in tasks that require selective attention)
- emotional and motivational regulation.

This seems to suggest a reasonable explanation: people who are prone to media multi-tasking also demonstrate reduced cognitive control (over their attention) and a reduced ability to regulate their emotion (for example, the urge to open a message immediately on receiving it in anticipation of emotional gratification).

Note

The study is correlational, so the result can be potentially explained in both directions.

- Individuals with lesser grey matter volume in the ACC are more susceptible to media multi-tasking.
- Engaging in multi-tasking affects grey matter density in the ACC through neuroplasticity.

SUMMARY: THE POSITIVE AND NEGATIVE EFFECTS OF MODERN TECHNOLOGY ON COGNITIVE PROCESSES

Research discussed so far in this section highlights both positive and negative influences of digital technology on cognition. Here is a summary.

Positive influences

- Videogaming may enhance visuospatial skills that may be further applied in related real-world tasks (Rosser *et al* 2007)—the study of laparoscopic surgeons).
- Such skills acquired in videogames may even be transferred to wider domains such as science learning (Sanchez 2012—study of students learning about plate tectonics).

Negative influences

- Induced media multi-tasking, and increased consumption of digital media in general, leads to attention problems, see Swing *et al* (2010).
- This may result in lower school achievement: Rosen, Carrier and Cheever (2013)—media multi-tasking negatively correlated with GPA.
- This is corroborated by neuroimaging—media multi-tasking affects areas that are responsible for cognitive control and emotional regulation: Loh and Kanai (2014).

EMOTION AND COGNITION IN THE CONTEXT OF DIGITAL TECHNOLOGY

As we know, cognition is closely linked to emotion. Emotional variables are an integral part of cognitive processes such as thinking and decision-making. See the **"Adaptive decision-maker framework"** in **"2.1.3 Thinking and decision-making"**. Emotional reactions can modify our memory and even trigger special memory mechanism. See **"Flashbulb memory"** in **"2.3 Emotion and cognition"**. Conversely, cognitive appraisal modifies emotional reactions and influences the way we experience emotion.

Another example of a phenomenon that is a product of interaction of emotion and cognition is **empathy**.

- The cognitive dimension of empathy includes one's ability to process emotional information: take perspectives of other people, understand what they feel and analyse a situation through their eyes. Perspective-taking is a major component of a special cognitive ability known as Theory of mind. See **"7.1.3 Development of empathy and theory of mind"** in **"Unit 7 Developmental psychology"**.
- The emotional dimension of empathy is feeling what other people feel. It can probably be viewed as a consequence of the cognitive dimension: to feel what other people feel, you first need to understand it.

The question is, does interaction with digital technology influence the way people cognitively process emotional information?

RESEARCH Konrath, O'Brien and Hsing (2011)—decline in empathy scores over time

Essential understanding

✪ *The average empathy scores in US college students have been falling with the course of time, and the trend is consistent with the onset of the digital era (especially social networks and mobile phones).*

Aim

To examine changes in empathy scores in US college students over time.

Method

A cross-temporal meta-analysis; correlational study; Interpersonal Reactivity Index (IRI—Davis 1980) was used in the research studies to measure empathy (both its cognitive and emotional components).

Participants

72 samples of US college students who completed a self-report measure of empathy some time between 1979 and 2009 (the total number of participants is almost 14,000).

Procedure

The Interpersonal Reactivity Index (IRI) is a personality scale that measures both emotional and cognitive components of empathy, such as empathic concern (emotional) and perspective-taking (cognitive).

Scores on the IRI were correlated with the year of data collection.

Results

- More recent generations of college students progressively reported lower scores, both on empathic concern and perspective-taking.
- The most dramatic changes occurred between 2000 and 2009. This coincides with the time when major social network sites became popular, as well as with the wide use of cell phones.

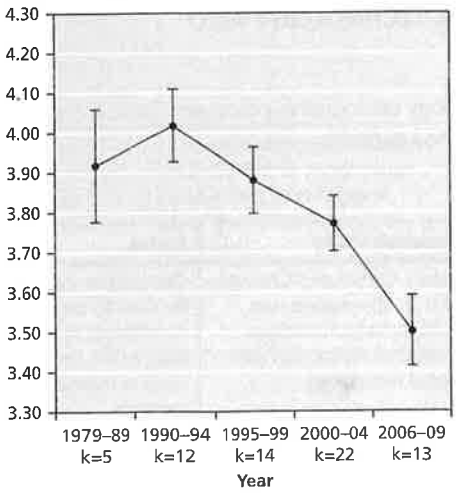

Figure 2.10 College students' empathic concern scores by period
Source: Konrath, O'Brien and Hsing (2011: 186)
Note: Capped vertical bars denote ± I *SE*.

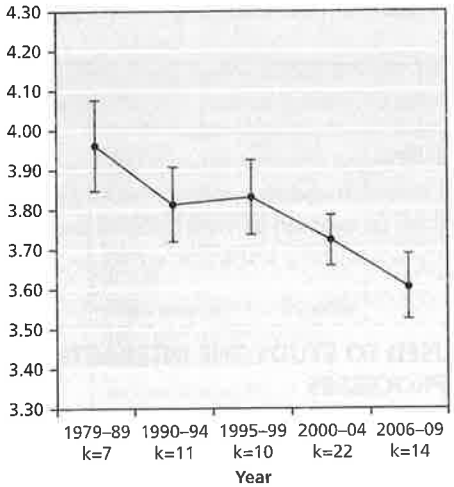

Figure 2.11 College students' perspective-taking scores by period
Source: Konrath, O'Brien and Hsing (2011: 186)
Note: Capped vertical bars denote ± I *SE*.

Conclusion

Discussing the possible reasons behind the observed trends, the authors point at the fact that this decline in empathy scores coincides with the onset of the digital era: "younger people more frequently remove themselves from deep interpersonal social situations and become immersed in isolated online environments" (Konrath, O'Brien, Hsing 2011).