# PSYC1022: The Psychology of Addiction
# Topic 13: Behavioural interventions (II)

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**Outline:**

- Contingency management
- Cue extinction therapy
- Cue re-training therapy
- Working memory training
- Mindfulness


## Contingency management (CM)

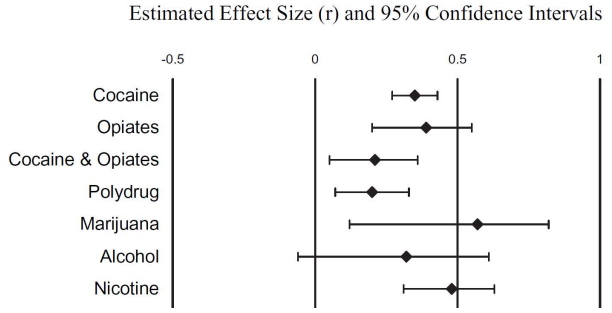
A treatment approach based upon the ideas within behavioural economics & choice (utility) theory, stemming from Herrnstein's matching law that humans & animals will choose whichever course of action has the greatest payoff in terms of reward relative to costs (Higgins et al. 2004).

In a treatment setting, this involves providing addicts with money (or vouchers) if they remain abstinent.

## Contingency management

Lussier et al. (2006): compared the difference in abstinence rates during treatment in groups who received vouchers contingent upon abstinence compared to a group who received a control intervention.

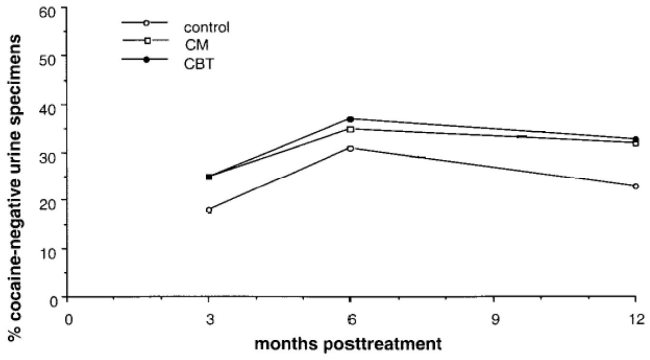
- 0 = no difference, 1 = large improvement in abstinence between CM vs. controls
- Mean effect size was .32, indicating that overall, CM participants outperformed about 60% of the controls (10% improvement in abstinence rates).




## Contingency management

Epstein et al. (2003): cocaine-using methadone-maintained opiate addict outpatients were randomly allocated to CM, CBT, or no-treatment control.

- abstinence rates were 10% higher in the two treatment groups at 3, 6 & 12 months later
  - suggests that improvements in abstinence achieved by CM are maintained (at least for 1 year after treatment has terminated).



# Contingency management

Silverman et al. (2001): heroin or cocaine dependent participants assigned to a therapeutic work based program: $7 voucher on the 1st day they provided a drug-free urine sample & completed a 3-hr work shift. The value of the vouchers increased by $.50 for each consecutive successful day, to a maximum of $27 per day. If a patient either provided a drug-positive urine sample or no sample, or failed to attend the workplace on a scheduled workday, the value of the next day's voucher was reset to $7.

- 30% of the CM screened abstinent at all time points compared to 5% of the controls.
- 25% improvement in abstinence rates in the CM demonstrates feasibility of implementing a morally acceptable CM treatment with clear therapeutic benefits.

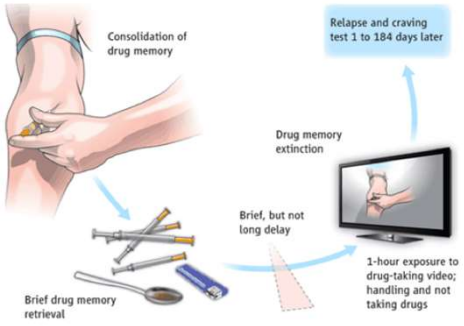
*Percentage of Participants Abstinent at All Time Points*

| | % participants | | | |
|---|---|---|---|---|
| Measure | Control ($n$ = 20) | Therapeutic Workplace ($n$ = 20) | $\chi^{2c}$ | $p$ |
| Urinalysis | | | | |
| Cocaine | 5 | 30 | 4.33 | .04 |
| Opiates | 5 | 30 | 4.33 | .04 |

# Cue-extinction therapy

CS paired with positive drug intoxication (US) will come to elicit an excitatory physiological response, which manifests as subjective craving & motivates drug-seeking & drug-taking (CR).

- Strategy in cue exposure treatment is to present addicts with drug cues without drug intoxication, such that the relationship between these stimuli (CS) & the drug effect (US) is degraded, reducing the ability of the stimulus to motivate drug use (CR)




Milton & Everitt (2012)

# Cue-extinction therapy

Conklin & Tiffany (2002): reviewed studies of the effectiveness of cue-exposure treatment.

- Overall effect size was *d* = 0.0868, indicating that there was no significant difference in the rates of relapse between the extinction & control groups. Thus, it was evident that cue-exposure treatment, at least as implemented by these nine studies, was not an effective treatment for addiction.

**Table 1** Summary of cue-exposure treatment studies.

| Study | Drug[a] | I/O[b] | I/G[c] | Adjunct treatment[d] | Abstinent[e] | No. of sessions[f] | CE length (min.)[g] | Session spacing[h] | Exposures per session[i] | Cues[j] | Criteria for ending exposure[k] | Follow-up[l] | Effect size (d =)[m] |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Corty & McFall (1984) | N | OP | I | Y | N | 8 | NI | M | I | A | F | 1, 3, 6 months | −0.4500 |
| Childress *et al.* (1987) | O/C | IP | G | Y | Y | 20 | 60 | S | 9 | A,V,IV | F | — | — |
| Dawe *et al.* (1993) | O | IP | I | Y | Y | 6 | 41–80 | S | 2 | P,V,IV | R-B | 6 weeks, 6 months | +0.0805 |
| Drummond & Glautier (1994) | A | IP | I | N | Y | 10 | 50 | M | 2 | IV | F | 1, 3, 6 months | +0.17–3 |
| Franken *et al.* (1999) | O | OP | I | N | Y | 9 | 45–50 | S | V | P,V,IV | R-B | 6 weeks | — |
| Götestam & Melin 1983) | N | OP | I | N | Y/N | 6 | NI | M | I | I | F | 1 month | — |
| Kasvikis *et al.* (1991) | O | IP | I | N | Y | 14 | 45 | M | V | P,IV | R-B | 1, 3, 6 months | — |
| Lowe *et al.* (1980) | N | OP | G | Y | Y/N | 8 | V | S | I | IV | R-B | 48 h, 3, 6 months | −0.5180 |
| McLellan *et al.* (1986) | O | OP | I | Y | Y[1] | 35 | 10–15 | S | V | P,A,V,I,IV | F | — | — |
| Monti *et al.* (1993) | A | IP | I | Y | Y | 6 | 55 | S | 3 | I,IV | R-B | 0–3, 3–6 months | +0.7345 |
| Niaura *et al.* (1999) | N | OP | I | Y | N[2] | 5 | 75–90 | S | 4 | I,IV | R-B | 1, 3, 6, 12 months | −0.2029 |
| O'Brien *et al.* (1990) | C | IP | I | Y | Y | 15 | 60 | S | 3 | A,V,IV | F | — | — |
| O'Brien *et al.* (1979) | O | OP | I | Y | Y[3] | 18 | 60 | S/M | I | IV | F | 6 months | — |
| Powell *et al.* (1993) | O | IP | I | Y | Y | 2 | 45–50 | S | V | P,IV | R-B | — | — |
| Rankin *et al.* (1983) | A | IP | I | Y | N[4] | 12 | 65 | S | I | I,IV | F | — | — |
| Raw & Russell (1980) | N | OP | G | Y | Y/N | 7 | 45 | S | V | IV | F | 3, 6, 12 months | −0.0251 |
| Rohsenow *et al.* (2000) | A | IP | I | Y | Y | 10 | 50 | M | V | I,IV | R-B | 6, 12 months | +0.5420 |
| Sitharthan *et al.* (1997) | A | OP | G | Y | N | 6 | 90 | S | 2 | IV | F | 6 months | +0.6070 |

[a]Drug of abuse: A = alcohol; N = nicotine; C = cocaine; O = opiate [b]Treatment setting: IP = inpatient; OP = outpatient [c]Therapy: I = individual; G = group. [d]Adjunct treatment used with cue exposure? Y = yes; N = no. [e]Abstinence status: Y = abstinent; N = non-abstinent; Y/N = smoking cessation study in which abstinence started halfway through treatment or smokers were not specifically told to quit. [1]Patients maintained on methadone? [2]some patients maintained on nicotine replacement; [3]some patients maintained on naltrexone; [4]patients instructed to control drinking (2–3 drinks per occasion), but remain abstinent on treatment days. [f]Number of cue-exposure treatment sessions. [g]Minutes of cue-exposure per session: NI = no information given; V = variable. [h]Spacing of treatment session: M = massed (daily sessions); S = spaced (other than daily sessions). [i]Number of cue exposures per treatment session: V = variable [j]Cues: A = audio; P = photographic; V = video; I = imagery; IV = *in vivo*. [k]Criteria for ending exposure: F = fixed; R-B = response-based [l]Follow-up: Dash = no follow-up conducted [m]Effect size: Dash = information allowing for the calculation of an effect size not given.

# Cue-extinction therapy

Four Context and Extinction Phenomena That May Provide Mechanisms of Relapse

| Phenomenon | Description |
|---|---|
| Reinstatement | Recovery of behavior that occurs when the subject is exposed to the US after extinction. Strongly controlled by contextual conditioning produced when the US is presented, hence the phenomenon is strongest when the CS is tested in the context in which the US has occurred. |
| Renewal | Recovery of extinguished behavior that can occur when the context is changed after extinction. Most often observed when the subject is returned to the original context of conditioning, but it also depends in part on mere removal from the extinction context. |
| Spontaneous recovery | Recovery of responding that occurs when the CS is tested after time has passed following the conclusion of extinction. |
| Reaquisition | Recovery of responding that occurs when the CS is paired with the US (or reinforcer) again after extinction. Often rapid, especially when cues in the background renew conditioned performance (as above). Can be slow when the background cues continue to retrieve extinction. |

CS, conditional stimulus; US, unconditional stimulus.
Bouton (2002)

Extinction effects abolished by 4 phenomena.

- all involve change in context between extinction training & test.
- subject assumed to acquire a belief that the drug is no longer available in the extinction context, following a shift to the alternative context, they assume the drug is likely available & starts responding for the drug again.

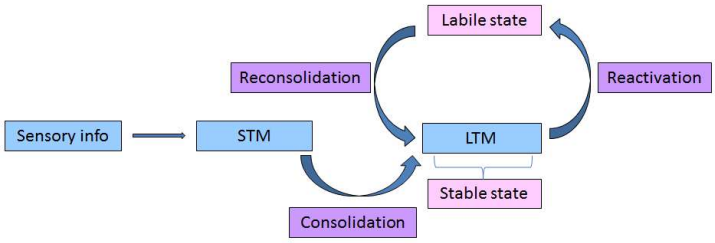
Conklin & Tiffany (2002): argued that any of these mechanisms might be responsible for the failure of cue-extinction treatments to prevent relapse.

- extinction procedures used were either Pavlovian (involving unreinforced presentation of drug cues) or instrumental (involving non-reinforced 'mock' drug-taking).
- In the natural environment, drug cues act as discriminative stimuli (signal when drug-seeking response will be reinforced).
- Pavlovian & instrumental extinction training may have little impact discriminative signaling, so this fails to produce long term abstinence.

# Cue-extinction therapy

According to current memory theory, memories are first input as sensory information into short term memory (STM) after which they are consolidated into long term memory (LTM).

- When you reactivate (retrieve) these memories into mind they are taken out of LTM & become 'labile' because they may be disrupted prior to being put back (reconsolidated) into LTM.
- Introspective evidence for this claim comes from one's difficulty in distinguishing between true memories of an original event & subsequent recollections of that event. This is because the LTM only contains the last retrieval (reactivation) of the event, rather than a veridical trace of the original event.
- Researchers interested in drug cue-extinction treatments have adopted the idea that reactivation (retrieval) of drug memories may make them vulnerable (labile) to extinction training.



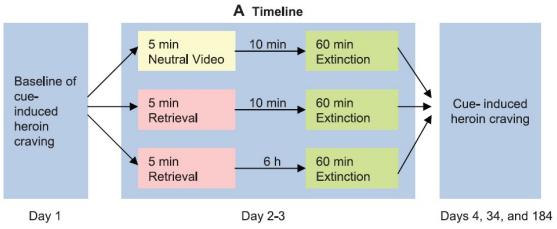

# Cue-extinction

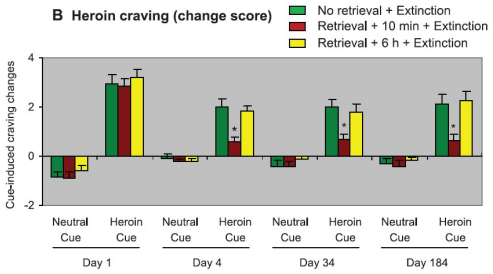
Xue et al. (2012): presented abstinent heroin addicts with 5 min video of heroin use to reactivate drug memories into the labile state. A longer 1-hr heroin video then followed to extinguish these cues.

- video-elicited craving assessed over several days up to 184 days later.
- retrieval + immediate extinction showed < cue-induced craving than no retrieval + ext. & retrieval + 6hr extinction.

Suggests that reconsolidation processes may be important for improving cue-extinction efficacy.

- Iremains to be seen whether retrieval-extinction treatments will improve relapse rates in clinical trials.

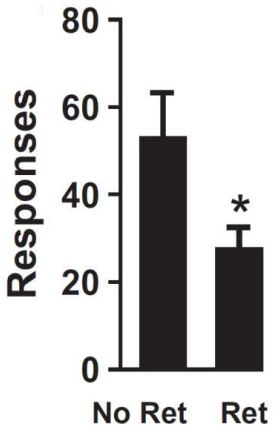


## Cue-extinction therapy

Millan, Milligan-Saville & McNally (2013): rats trained to self-administer beer. In the subsequent 10 min retrieval session, responding produced no beer. Then, following a short delay a 50 min extinction session occurred in which responding again produced no beer (i.e. a longer version of the retrieval session).

- when rats were tested for responding for beer, those in the retrieval-extinction group (RET) responded less than the group that had received only extinction training (no RET).



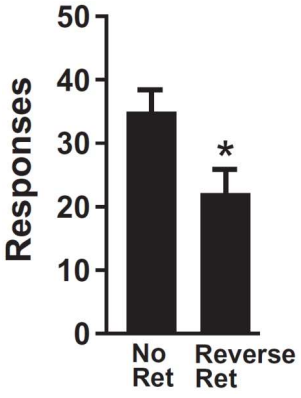

## Cue-extinction therapy

However, in a subsequent experiment the order of the retrieval-extinction treatments were reversed: rats received extinction training followed by the shorter retrieval session.

- extinction-retrieval training was equally effective at reducing responding for beer as retrieval-extinction training.

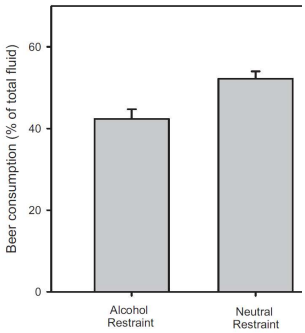
Thus, placing drug memories into a labile state in a short retrieval session may not be important for enhancing extinction learning.

- Rather, learning that extinction of alcohol seeking is reliably in force over multiple sessions may be more important for expression of this learning in the test phase.




Millan, Milligan-Saville & McNally (2013)

## Cue-retraining therapy




Cognitive psychologists: addiction driven by a biased processing of drug related cues. Training new inhibitory responses to drug cues should provide a treatment for addiction.
Jones & Field (2013): trained heavy student alcohol drinkers on an alcohol "stop signal" task. In each trial an alcohol or neutral picture appeared to which subjects had to press the X or O key respectively. On stop signal trials, a tone was played immediately after the picture was presented, which signaled that subjects should *not* press the X or O.

- Alcohol Restraint group: stop signal tones occurred when the alcohol picture was present. Neutral Restraint: stop signal tones occurred when the neutral picture was present.
  - Alcohol Restraint group learned to withhold key press selectively in the presence of alcohol cues.
- In bogus taste test that followed subjects could consume as much beer & fruit juice as they liked. Alcohol Restraint group drank < beer than Neutral Restraint group

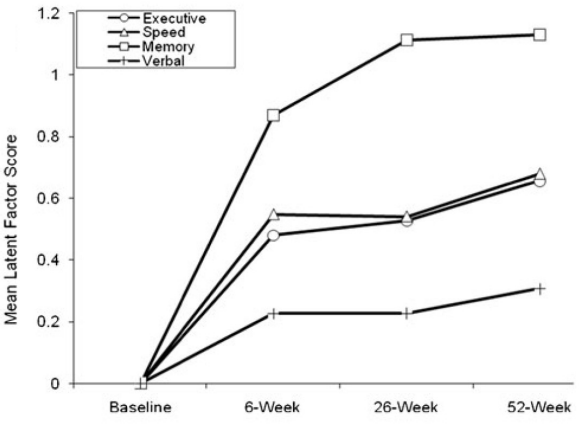
Suggests that learning to inhibit simple button pressing in response to alcohol cues can generalise to decrease actual beer consumption.

- 1 week follow up: no reduction in alcohol consumption, treatment effects are short lived/easily abolished.

## Working memory training

Poorer cognitive function predicts higher likelihood of relapse. In addition, successful abstinence has been associated with a progressive improvement in cognitive function across a variety of domains: executive control, information processing speed, memory function & verbal skill.

- Implies that treatments which enhance cognitive function should improve abstinence rates.




Bates et al. (2013)

# Working memory training

Restricted temporal horizons is a core cognitive impairment underpinning the persistence of drug use which is characteristic of dependence. Improving capacity to represent long term consequences of choice should promote successful abstinence.

Bickel et al. (2011): examined whether extended working memory training would reduce delay discounting.

- 27 adults in treatment for cocaine or meth use were given either working memory training or control training over 5-15 sessions. Training involved the following computer based tasks:
  1. Sequence recall of digits
  2. Sequenced Recall Reversed Digits
  3. Sequenced Recall of Words
  4. Verbal memory
- Working memory group: had to perform these memory training tasks,
- Control group: received the same tasks with the same trial sequence, but the correct answer was highlighted such that memory was not required for successful completion.

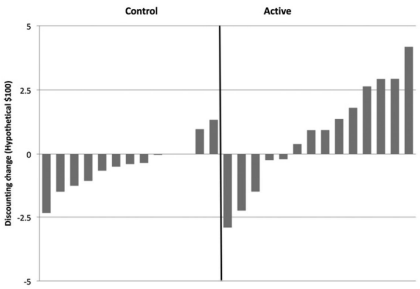
# Working memory training

Change in delay discounting from before to after the memory training session for all subjects ranked in order.

- Negative values indicate an increase in discounting (increased preference for smaller-immediate rewards)
- Positive values indicate a decrease in discounting (increased preference for larger-later rewards- indicative of an extended temporal horizon)
- 9 subjects in the active group showed improved temporal horizon compared to only 2 of the controls

Thus, working memory training enabled addicts to better evaluate the long term consequences of their choices.

- remains to be empirically confirmed whether this results in better treatment retention or long term abstinence rates




Change in discounting ln(*k*) for individual participants in the active and control groups, calculated as pretraining minus posttraining. Positive values indicate a decrease in discounting.

Bickel et al. (2011)

# Mindfulness training

Involves learning to meditate & reflect upon one's internal sensations, including craving & emotion states
- accept these sensations & not act upon them (note the similarity to 'urge surfing')

Brewer et al. (2011): randomly assigned 88 treatment-seeking, nicotine-dependent adults to receive mindfulness training (MT) or the American Lung Association's freedom from smoking (FFS) treatment.

1. MT introduced the concept of how smoking can become a habitual behaviour triggered by environmental, physical, or emotional events; and explored how craving feels in the body.
2. Examined how thoughts, emotions & body sensations become triggers for craving & smoking. Introduced a technique to 'mindfully' work with cravings.
3. Discussed how difficult emotions perpetuate smoking as well as a meditation technique called loving-kindness as a way to work with them.
4. Taught participants how cravings thwart long-term goals & reinforced mindfulness techniques as a way to help individuals disengage from habitual responding & realign with their goals.
5. Introduced participants to mindfulness practice in everyday life, including "awareness of breath" meditation & mindful walking.
6. Explored the automaticity of thought & how thoughts can lead to habitual behaviours.
7. Reinforced the concept of acceptance & its role in changing habits. It also explored how both mental & physical actions can "plant seeds" for future actions and habits.
8. Summarized the course tools & explored ways of maintaining these in the future.

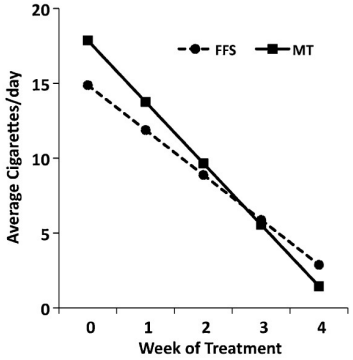
- Home practice suggested after each session.

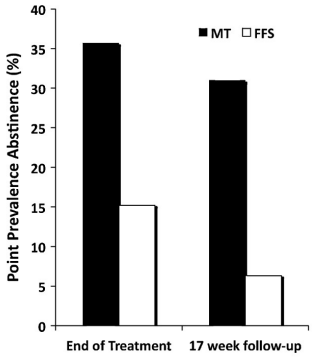
# Mindfulness training

Brewer et al. (2011)

MT group reduced smoking more quickly over the 4 weeks of treatment than FFS group.
- % abstinent greater in the MT vs FFS group both at the end of treatment (week 4: 36% vs. 15%) & at follow up (13 weeks later: 31% vs. 6%).
- There is also evidence that MT can improve abstinence from other drugs of abuse (Chiesa & Serretti, 2013)

These data suggest that self-control is a skill which can be taught & has therapeutic efficacy for abstinence.



## Summary

Knowledge & understanding of:

- Relapse rates comparable across substances & treatment approaches (including self-quitters)
- Characteristics, rationale & techniques of TSF, CBT, MET
- No evidence of sig. differences in efficacy of various treatments
- Evidence for efficacy of contingency management approaches in both short & long term
- Cue extinction therapy: behaviourist rationale but lacking clinical evidence of efficacy
- Cue re-training therapy: cognitive rationale but only short term
- Working memory training: cognitive rationale but not clinically tested
- Mindfulness training: some positive therapeutic benefits.