SENSURVEILEDNING

Emnekode og navn:	Semester / År / Eksamenstype:
PSYPRO4412	V20 – 4 timer hjemmeeksamen

Oppgave:

Long questions (Choose two of three, each counts as 40% of the final grade)

Question 1: Hva er beregningspsykiatri (computational psychiatry) og hva er poenget, om noen?

Question 2: Hva slags impulsivitet er det? Har distinksjonenen virkninger på den virkelige verden?

Question 3: Hvordan vil du utforme et atferdsendringsprogram? Hvilke teretiske betraktninger styrer designet ditt?

Short questions (Choose one of two, each answer counts as 20% of the final grade)

Question 1: Hvordan, og i hvilken grad er det mulig å skille fra hverandre autentiske og falske gjenkalte fortrengte minner?

Question 2: Hva er forskjellen mellom "actor-critic" læring og Q-læring, og hvorfor betyr det noe?

Relevant pensumlitteratur:

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Eksamenskrav:

Long questions (Choose two of three, each counts as 40% of the final grade)

Question 1: Hva er beregningspsykiatri (computational psychiatry) og hva er poenget, om noen?

What is computational psychiatry, and what is the point, if any?

Computational psychiatry is a cognitive approach to mental health. Cognitive psychology is concerned with how minds do what they do, at the algorithmic level. The aim is to find a description of the rules and equations that can generate observed behaviour, ideally precisely enough to be able to reproduce that behaviour. Such rules and equations have quantitative parameters, and these differ between individuals. Examples of such parameters would be working memory capacity, or in the dot motion task non-decision time, drift rate, decision boundaries, and bias, or in Frith's theory, how much prediction error is overestimated. For contrast, the five personality dimensions are too vague to be considered computational parameters. Computational psychiatry assumes that there will be problems when computational parameters deviate enough from the average, and different patterns of deviations correspond to different mental health problems. The hope is that computational psychiatry will be able to achieve the following goals:

1) Revise diagnostic criteria. For example, Fair et al found that normally developing children showed six different multidimensional profiles in children diagnosed with ADHD, four of which were also found in normally developing children, and two more were subtypes of those four. That indicates that ADHD is not a single condition. Another example is that there are four different kinds of impulsivity. Gold et al.'s picture discrimination task can distinguish impairments in stimulus-response (model free or actor-critic) learning from impairments in representing either positive or negative outcomes in response-outcome (model based or Q) learning. Problems with representing positive outcomes are associated with negative symptoms in schizophrenia, problems with representing negative outcomes are associated with pathological gambling.
2) Identify underlying mechanisms (at the algorithmic level) through measurement of computational parameters: for example, learning from positive or negative prediction errors; changes in bias, drift rate or decision threshold in the drift-diffusion model, depth of recursion in the stag-hunt game, sensitivity to fairness in the trust game; four kinds of impulsivity.
3) Assess specific effects of treatment on those more precisely identified mechanisms. We have no examples in the pensum. Somewhat related is identifying different kinds

of ADHD by their neural correlates, and finding that they respond to different treatment.

4) Perhaps use such assessments to design new treatments (not done yet as far as I know). For example, reduced ability to represent positive outcomes is found in schizophrenia patients with negative symptoms. Reduced ability to represent negative outcomes is found in gamblers. If behavioural treatments can be found that selectively changes these parameters, patients could be brought back closer to the normal range. If the parameters at the algorithmic level can be linked to specific aspects of physiology, that could lead research into more precisely targeted drugs, or neurofeedback treatments.

Question 2: Hva slags impulsivitet er det? Har distinksjonenen virkninger på den virkelige verden?

What kinds of impulsivity are there? Do the distinctions have real world implications?

Sensorveiledning: Wiecki et al. list four kinds of impulsivity. The better students may notice something Wiecki et al did not mention: temporal or delay discounting, reward sensitivity and speed accuracy trade-offs apply to decisions with outcomes that are delayed over a wide range of time intervals, from less than a second to centuries. Failures of inhibition apply to responses typically less than a second delayed.

Caswell et al. initially describe three kinds of impulsivity, and their factor analysis indicates there are four. Two of these are also in Wiecki et al.'s list, a further two are different, but not precisely specified. The pensum thus describes six kinds of impulsivity, of which four are clearly explained:

1) Temporal discounting (what Caswell et al. call temporal impulsivity) is treating events as less important the more they are delayed. The standard procedure to estimate temporal discounting is to offer a choice between one fixed and once variable amounts, at one fixed and one variable delay. For example, offered a choice between two new 100 kr bank notes right now, one should be indifferent between the two. Next, offer 100kr tomorrow, and vary the alternative amount offered right now until finding the indifference point, say 90 kr. Then offer 100 kr in two days, and again find what amount is subjectively worth the same if paid immediately, say 82 kr. That variable amount indicates how much the 100 kr are worth at the delay that has been specified. The steeper that temporal discounting is (the more subjective value declines with delay), the greater the preference for an immediate over a delayed reward. Steep temporal discounting is one of the kinds of impulsivity associated with ADHD, and with nicotine use.

2) Reward sensitivity refers to how much people are motivated by positive as opposed to negative outcomes. It can be measured by learning tasks involving gains and

losses, and checking to what extent choices are explained by memory for either gains or losses. Greater sensitivity for losses is associated with the negative symptoms of schizophrenia, greater sensitivity for gains with pathological gambling, and with ADHD. Reward sensitivity is not one of the four factors identified by Caswell et al.

3) Speed accuracy trade-offs occur in sequential sampling tasks in which people can choose how much data they sample before making a decision. Because the rate at which data become available is not, or not entirely, available under one's own control, gathering more data takes more time. That forces a trade-off between speed, a fast decision relying on les data, and accuracy. Examples of sequential sampling tasks in the laboratory would be the random dot motion task, the beads task, or the box task. Examples of real life sequential sampling problems would be deciding where to go on holiday, or whether to propose marriage. People with ADHD adjust speed, and consequently the amount of data gathered, less than controls in response to task demands. Impaired speed accuracy trade-off is associated with greater risk of being a perpetrator or victim of violence

4) Motor impulsivity corresponds to failure of inhibition, as measured by the stop signal task or the Stroop task. Real life examples would be inability to stop oneself from making inappropriate remarks. This is factor 1 of Caswell et al.'s analysis. Motor impulsivity does occur in ADHD. Chamberlain et al. found reduced motor inhibition, as measured by the stop signal task, in both OCD and trichotillomania (compulsive hair pulling). The conditions differ in that OCD sufferers also show less cognitive flexibility.

5) Caswell et al. describe reflection impulsivity as involving a general preference for speed. The task they use to measure it does have speed and an accuracy version, but their analysis seems to be not sensitive to speed accuracy trade-offs. Reflection impulsivity seems to correspond to the jumping to conclusions bias in the beads task shown by schizophrenia patients, not an impaired speed accuracy trade-off. However, the link between reflection impulsivity and jumping to conclusions is not confirmed by empirical data, and therefore students are not expected to go into detail.

6) Caswell et al.'s third factor is measured by the immediate memory task. It is not clear why it is considered a measure of impulsivity. Therefore students are again not expected to go into detail.

Dalley et al. found that drug taking in humans is associated with a questionnaire-based measure of impulsivity, and with one aspect of sensation seeking. Rats bred for impulsivity consume more cocaine than rats bred to be less impulsive, and worked harder for nicotine and sugar.

There is some evidence that different kinds of impulsivity are selectively associated with different real world problems. It is less clear, from the material in the pensum, how impulsivity is associated with mental health conditions. Wiecki et al. mention some kind of impulsivity being associated with ADHD, OCD, Tourette's syndrome, substance abuse, gambling, and eating disorders. It is less clear how specific those associations are, because patients with a particular condition may not have been tested for all kinds of impulsivity. ADHD is associated with all four kinds of impulsivity mentioned by Wiecki et al. Gambling, OCD and trichotillomania are mentioned in connection with only one kind of impulsivity each, but either patients were only tested for one kind, or it is not clear whether there were other tests.

Question 3: Hvordan vil du utforme et atferdsendringsprogram? Hvilke teretiske betraktninger styrer designet ditt?

How would you design a behavior modification programme? What theoretical considerations guide your design?

Sensorveiledning: The basic problem with inducing behavior change is relapse, and one important cause of relapse is that behavior modification training often does not affect the original learning that causes undesirable behavior, but causes new learning. That means there are competing and conflicting pieces of information in memory. The new learning is often context-specific, and relapse may occur when returning to the context of original learning. That would be an example of ABA renewal, where A is the original context and B is the context in which the learning occurs that is supposed to change behavior. Students may choose to define and explain AAB, ABA and ABC renewal as well as spontaneous recovery, reinstatement, rapid reacquisition and resurgence, or they may choose just to mention these problems and focus on how to address them. There are several approaches.

One possibility is to accept that new learning is context-specific, but try to make it as effective as possible, and to get around context specificity to some degree by training in multiple contexts. Further, if extinction proceeds very gradually, for example in extinguishing fear conditioning by starting with the least scary situations, there is the risk that reduced fear is based mostly on the non-associative process of habituation. If instead mildly and quite scary situations are mixed, then prediction error is kept high enough to increase learning rate and speed up new learning. It also helps if subjects are encouraged to make very specific predictions so that it is clear when those predictions fail. Prediction errors may also be increased by first extinguishing responses to several conditioned stimuli separately, then combining those stimuli, by removing safety signals (when treating phobias, cognitive treatments that reduce anxiety would also reduce prediction error and should therefore only be given *after* extinction training), and by occasional CS-US pairings. Generalisation of the new learning is encouraged by varying the conditioned stimuli and the contexts in which they are presented.

An alternative view is that a sudden change in the relationship between conditioned and unconditioned stimulus acts like a context change and that this is what triggers new learning. If instead the probabilistic relationship is changed more gradually (though presumably not so gradually to risk relying on habituation alone), then the original association is modified. This avoids the context specificity of new inhibitory learning and so avoids renewal and reinstatement. This approach seems to contradict the idea of maximizing prediction error, yet the emphasis is on a gradual change, not on the magnitude of prediction error.

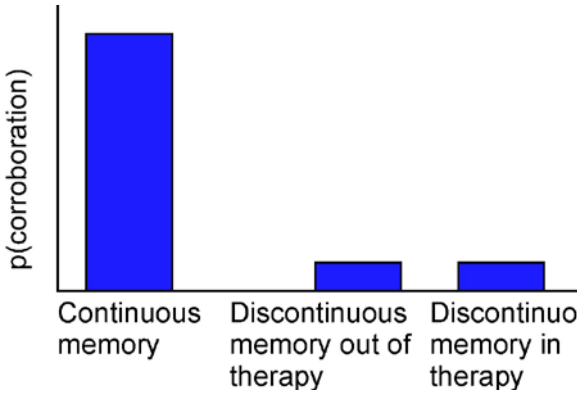
Finally, reconsolidation may be employed. Within a time window more than 10 minutes but less than 6 hours after retrieval, a memory may be labile and thus modifiable. The memory may then be modified through extinction training within that time window, or a range pharmacological interventions, most commonly administration of cortisol. As in the case of gradual change of the CS-US relationship, targeting the original memory avoids the effects of context specificity such as renewal, spontaneous recovery and resurgence.

Short questions (Choose one of two, each answer counts as 20% of the final grade)

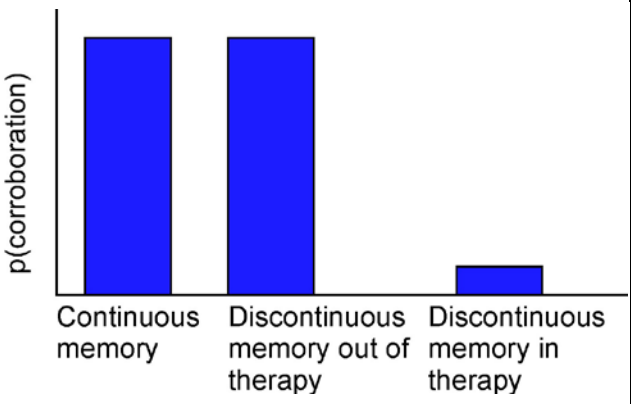
Question 1: Hvordan, og i hvilken grad er det mulig å skille fra hverandre autentiske og falske gjenkalte fortrengte minner?

How and to what extent is it possible to distinguish between true recovered memories and false memories?

Sensorveiledning: Geraerts et al. list three possible predictions regarding the probability that memories of sexual abuse are corroborated by independent evidence:

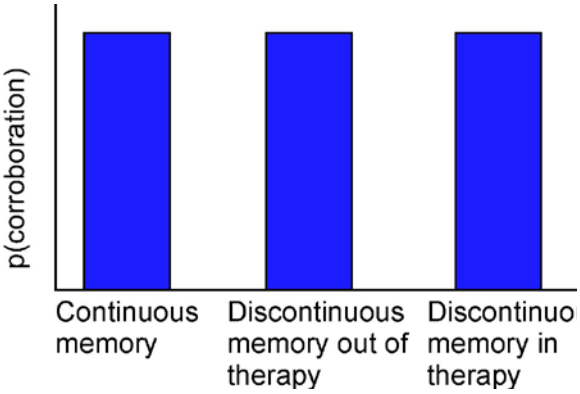


1: Only continuous memories are reliable

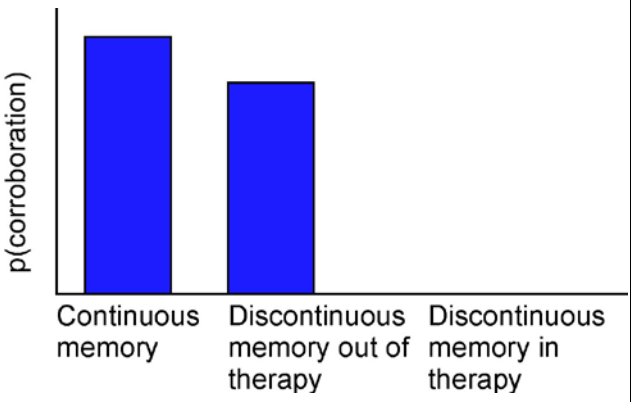


2: Memories recovered out of therapy are reliable

3: All recovered memories are reliable



Result



In this study, *none* of the memories recovered in therapy was corroborated by independent evidence, while memories recovered out of therapy were as likely to corroborated as continuous memories (those that had never been forgotten). Geraerts et al. do not mention whether the therapy in question was specifically recovered memory therapy or a broader range of therapies. They do point out that the best predictor of the existence of corroborating evidence was being surprised by the memory. Memories that were corroborated also tended to be recovered suddenly, rather than gradually.

Question 2: Hva er forskjellen mellom "actor-critic" læring og Q-læring, og hvorfor betyr det noe?

What is the difference between actor-critic learning and Q-learning, and why does that matter?

Sensorveiledning: In actor-critic (model-free, stimulus-response, habitual) cognition, you choose whatever response has been best rewarded in the past in this situation, while this stimulus was present.

For example, if you learn to find your way around by actor-critic learning, you just know that in the presence of *this* stimulus (this place), you choose the response of going in *this* direction, without knowing where that will take you, what you will find at the end of this chain of stimulus-response associations, or how long it takes to get there. Or you might habitually prepare a food that you don't like any longer because the last time you ate it, you became violently ill. Stimulus-response learning does not represent the outcome, and so it is not immediately sensitive to changes in the value of the outcome. Only new (and slow) learning can change the response.

In Q learning (model-based, response-outcome or stimulus-(response-outcome) or goal-directed cognition), experience is compiled into a (possibly hierarchical) generative model of the world—a mechanistic, causal understanding of the causes and consequences of actions

and events. When faced with a particular situation, this model can be searched, and the quality of various behaviours deduced—even if they have never been tried or experienced. As this involves somehow simulating or inferring future possibilities, it can have high computational costs.

For example, if you learn to find your way around by associating a stimulus with a response-outcome association, meaning you represent the *value* or *quality* of the outcome, you can plan your path. If you are in the presence of *this* stimulus (you are *here*), you can say that if you perform *this* response (go in *this* direction) you will experience *this* outcome (end up in *this* place). Then you can take this imagined outcome as the stimulus for a new stimulus-(response-outcome) association, and so simulate a whole chain of actions.

One reason why the difference matters is that Q-learning, which represents the outcome, is immediately sensitive to changes in the value of the outcome. Therefore persuading client that an outcome is not desirable should quickly change behavior. The actor-critic learning system, however, will need to be retrained by actively monitoring habits (mindfulness) and substituting good new habits for the old, bad habits until the new habits stick.

Further, specific impairments have distinct outcomes. Impairments in representing positive outcomes in Q-learning is associated with negative symptoms in schizophrenia, while giving excessive weight to positive outcomes is associated with one form of impulsivity.

Karakterbeskrivelse:

Betegnelse	Generell kvalitativ beskrivelse av vurderingskriterier	Fagspesifikk beskrivelse med relevans for vurdering av besvarelser/arbeider med bestått/ikke bestått
Bestått	Kunnskapsmengde (teoretisk/empirisk) Innsikt (oversikt/forståelse) Fremstilling (struktur/begrepsapparat) Bruk (selvstendighet/originalitet)	Besvarelsen/arbeidet reflekterer tilstrekkelig relevant kunnskapsmengde og oversikt/forståelse av fagområdet. Besvarelsen/arbeidet er strukturert og har et noenlunde konsist begrepsapparat. Besvarelsen/arbeidet dokumenterer en viss grad av selvstendighet og evne til å trekke egne konklusjoner.
Ikke bestått	Mangler vesentlige kunnskaper. Utilfredsstillende fremstilling med klare feil og mangler	Besvarelsen/arbeidet reflekterer dårlig generell kunnskap og/eller faller på siden av oppgaven. Fremstillingen er ustrukturert, mangler oversikt over fagområdet og inneholder mange direkte feil.

Faglærer / oppgavegiver:

Navn:
Sted / dato: