Cognitive Remediation Training (CRT) and Metacognitive Training (MCT) for psychosis

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Schizophrenia: Levels of Understanding

**Trait (diagnosis)**
- Poor Functional Outcome
- Memory, Attention, Executive Function Impairments
- Dysfunctional Neural Networks

**State (symptom ratings)**
- Hallucinations, Delusions
- Biased Information Processing
- Dysfunctional Neural Networks

**Behaviour**

**Cognitive Function**

**Neuroanatomy**

**Extra/ intracellular/ genetic**
- neurotransmitters/neuroreceptors
- proteins/lipids
- genes
Schizophrenia: Research Model

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Trait (diagnosis)
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  - Cognitive deficits
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Cognitive deficits in schizophrenia

- Deficits in cognitive functioning are a reliable finding in schizophrenia spectrum disorders.
- The magnitude of cognitive deficits does not correlate with the severity of positive symptoms (Addington et al, 1991).
- The magnitude of cognitive deficits is a predictor of daily life functioning (Green, 1996), in domains including employment, independent living, and quality of life.
Cognitive deficits in schizophrenia

Bowie et al, 2008
Cognitive deficits in schizophrenia

Bowie et al, 2008
Cognitive deficits in schizophrenia

Bowie et al, 2008
Cognitive deficits in schizophrenia

**Figure 1.** Neuropsychological profile (NP) (± SEM) for neuroleptic naive patients with first-episode schizophrenia (open squares, n=37) and previously treated patients (solid squares, n=65) relative to healthy controls (dashed line, n=131). ATT indicates attention-vigilance; ABS, abstraction-flexibility; VBL, verbal intelligence and language function; SPT, spatial organization; VBM, verbal memory and learning; VIM, visual memory; VSM, speeded visual-motor processing and attention; and MOT, fine manual motor functions.

Saykin et al, 1994
Cognitive deficits in schizophrenia

Domains of particular weakness
- Attention
- Verbal memory
- Abstraction/ flexibility
- Speed of processing

**Figure 1.** Neuropsychological profile (NP) (±SEM) for neuroleptic naive patients with first-episode schizophrenia (open squares, n=37) and previously treated patients (solid squares, n=65) relative to healthy controls (dashed line, n=131). ATT indicates attention-vigilance; ABS, abstraction-flexibility; VBL, verbal intelligence and language function; SPT, spatial organization; VBM, verbal memory and learning; VIM, visual memory; VSM, speeded visual-motor processing and attention; and MOT, fine manual motor functions.
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  - Working Memory
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Functional Magnetic Resonance Imaging (fMRI) Study of Working Memory
Network 3 – Task Positive and Negative

Red: activations; Blue: deactivations

• Schizophrenia patients must generate higher activation in functional networks to produce performance equivalent to controls.

• When activation limits are reached, performance deficits can be observed.

• Impairment at high cognitive loads could affect everyday functioning, as well as the ability to manage the symptoms of psychosis.

• For example, managing delusional thoughts may involve keeping in mind that this thought is unlikely to be true, reminding oneself to perform reality checks despite mounting stress and strained social relationships.
Schizophrenia: Research Model

Trait (diagnosis)

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- Working Memory
- Inefficient Functional Brain Networks

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- Cognitive Function
- Extra/intracellular/genetic

Neuroanatomy
Schizophrenia: Research Model

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State (symptom ratings)
- Delusions
  - ?

Behaviour
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Understanding belief formation (and delusions)

• How do people arrive at decisions/ develop beliefs?
• How do people choose between different alternative explanations/ beliefs?
• Why don’t we always change our minds in the face of new evidence?
Understanding belief formation (and delusions)

• How do people arrive at decisions/ develop beliefs?
• How do people choose between different alternative explanations/ beliefs?
• Why don’t we always change our minds in the face of new evidence?
The probabilistic reasoning (beads) task

Show jars containing mainly black and mainly white beads

Hide jars from view

More items please

No more items. I have decided.
The probabilistic reasoning (Fish) task

The fish came from Lake A.

The fish came from Lake B.
The probabilistic reasoning (Fish) task

The fish came from Lake A.

The fish came from Lake B.
The probabilistic reasoning (Fish) task

The fish came from Lake A.

The fish came from Lake B.
Jumping to Conclusions (JTC)

Nonmatching Lake

Matching Lake

Healthy Controls
Bipolar Controls
Non-Delusional Sz
Delusional Sz

Cognitive biases in delusions (I)

- How do people arrive at decisions/ develop beliefs?
- Even in a neutral context, individuals who are prone to delusions seem to use less information to arrive at a decision, and are more confident in a decision which is consistent with their initial expectation.
- We call this a ‘hypersalience of evidence-hypothesis (EVH) matches’
  - E.g. I have an initial idea (“the CIA is watching me”), and I match evidence preferentially to that hypothesis (“people are staring at me”)
- The tendency to ‘jump to conclusions’ and the EVH has been found to moderate treatment response (Menon et al, 2008)
Understanding belief formation (and delusions)

• How do people arrive at decisions/ develop beliefs?
• How do people choose between different alternative explanations/ beliefs?
• Why don’t we always change our minds in the face of new evidence?
How likely is it that the jumping black fish came from the green lake rather than from one of the blue lakes?
Cognitive Neuropsychiatry
Conclusions from delusions research (II)

• How do people choose between different alternative explanations/ beliefs?
  – The self-selection nature of most delusions may contribute to hypersalience of evidence-hypothesis (EVH) matches.
Understanding belief formation (and delusions)

• How do people arrive at decisions/ develop beliefs?
• How do people choose between different alternative explanations/ beliefs?
• Why don’t we always change our minds in the face of new evidence?
1) The man has just built a fence for his dog.
2) The man is shopping for guard dogs.
3) The man has just escaped from the barking dog.
4) The man is playing with his neighbor’s barking dog.
1) The man has just built a fence for his dog.
2) The man is shopping for guard dogs.
3) The man has just escaped from the barking dog.
4) The man is playing with his neighbor’s barking dog.
1) The man has just built a fence for his dog. **Lure**
2) The man is shopping for guard dogs.
3) The man has just escaped from the barking dog. **True**
4) The man is playing with his neighbor’s barking dog. **Lure**
Bias Against Disconfirmatory Evidence (BADE)

<table>
<thead>
<tr>
<th>Rating Number</th>
<th>Mean Rating for LURES</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td></td>
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<tr>
<td>2</td>
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<tr>
<td>3</td>
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</tbody>
</table>

- **schiz: delusions**
- **schiz: no delusions**
- **bipolar controls**
- **healthy controls**
Conclusions from delusions research (III)

• Why don’t we always change our minds in the face of new evidence?
  – People with delusions have a particularly strong bias against disconfirmatory evidence (BADE)
  – Delusions may not be properly disconfirmed (e.g., that fact that suspected recording devices are not found in the heat vents is not integrated, because crackling on the phone line is a highly salient confirmation of the CIA delusion).
Conclusions from delusions research

- Delusions could be formed due to hypersalience of a match between evidence (e.g., people are staring at me) and a self-selected delusional idea (e.g., I think the CIA is spying on me).
- Delusions may not be properly disconfirmed (e.g., that fact that suspected recording devices are not found in the heat vents is not integrated, because crackling on the phone line is a highly salient confirmation of the CIA delusion).
- Delusions may be maintained and elaborated as evidence-hypothesis matches broaden and intensify (e.g., a black van passing by slowly suggests it is driven by an observant CIA agent).
- Personalizing factors must interact with hypersalience: expectations, hypervigilance, imagination/fantasy, memories/trauma
Schizophrenia: Research Model

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State (symptom ratings)
- Delusions
  - Hypersalience of evidence matches to self selected hypotheses, a bias against disconfirmatory evidence + Personalizing factors
  - ?

Cognitive Function
- Behaviour

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- Hypersalience of evidence matches to self selected hypotheses, a bias against disconfirmatory evidence + Personalizing factors
- Heightened activity in ventral striatum and limbic regions. Brain networks respond both to salent and non-salient information.

**Behaviour**

**Cognitive Function**

**Neuroanatomy**

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Schizophrenia: Treatment Model

Trait (diagnosis)
- Poor Functional Outcome
- Memory, Attention, Executive Function Impairments
- Dysfunctional Brain Networks

State (symptoms)
- Hallucinations, delusions
- Hypersalience of EVH matches Hyper-perceptualization
- Ventral striatum/limbic system (hypersalience)
  Rostrolateral Prefrontal Cortex (self-reflect, change belief?)

neurotransmitters/neuroreceptors
proteins/lipids
genes
Knowledge translation

• Can we use this research to help our clients improve their symptoms and daily life functioning?

• Cognitive remediation (CRT) to improve basic cognitive domains

• Metacognitive Training (MCT) to improve cognitive biases
Schizophrenia: Treatment Model

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- Cognitive biases
- Ventral striatum/limbic system (hypersalience)
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**Cognitive Remediation Training (CRT)**
- Proteins/lipids
- Genes

**Metacognitive Training (MCT)**
- Neurotransmitters/neuroreceptors
- Proteins/lipids
- Genes
Cognitive Remediation Training (CRT)

- **Group Structure**-
- 2 x one hour sessions per week to teach material
- Between session homework/practice to master material

Training Modules:
1. Attention
2. Processing Speed
3. Working Memory
4. Verbal Memory
5. Planning & Reasoning
Cognitive Remediation Training (CRT)

- Cognitive remediation (CR) uses computerized software to allows training of multiple cognitive domains
- CR with the computerized software (Scientific Brain Training Pro) has been used in individual and group settings in psychiatric facilities and practices worldwide
- Participants carry out individualized training on personal tablets and discuss real-life applications
- Difficulty level of the task is adaptive based on participant performance
Selective Attention:
Identify the “odd-one-out” in this grid of figures
Cognitive Remediation Training (CRT)

Selective Attention:
Identify the “odd-one-out” in this grid of figures

Private Eye
Series 1 of 10

Well done, you have found the odd-one-out!
Cognitive Remediation Training (CRT)

Verbal Memory:
Remember the words on this list.

Elephant Memory

scene  employee  trace  process
x-ray  psyche    genetics  ion
format neutron  jobless  picket

Continue
Cognitive Remediation Training (CRT)

Verbal Memory:
Identify the two other words that you saw on the list.

Elephant Memory

Now it's your turn to identify the 2 other words.

- diode
- genetics
- wording
- engineer
- magnolia
- psyche
- process
- condition
- x-ray
- glossary
- nature
- benefit
Cognitive Remediation Training (CRT)

Planning and Reasoning:
Move the rings to create the tower shown.
Cognitive Remediation Training (CRT)

Planning and Reasoning:
Move the rings to create the tower shown.
Cognitive Remediation Training (CRT)

Metacognitive Therapy (MCT)

• MCT was developed as a knowledge translation tool- to inform consumers of the results of over 20 years of cognitive neuroscience research on psychosis

• Based on clinical gains and feedback from the early sessions, it was developed into a structured CBT based clinical intervention

• Metacognitive Training- group intervention

• Metacognitive Therapy (or MCT plus)- individualized treatment
MCT and CBT

• Both methods aim to help individuals understand and explore cognitive biases and ways of thinking about their beliefs and symptoms.

• CBT helps individuals look at their thoughts.

• MCT takes a slight different approach and helps individuals think about the cognitive biases outlined earlier.
Click on flags below for your free version of the Metacognitive Training for Schizophrenia (MCT):

- German
- British or American
- Dutch
- French
- Spanish
- Farsi
- Polish
- Chinese (modern)
- Chinese (traditional)
- Hindi
- Korean
- Montenegrin
- Romanian
- Portuguese
- Norwegian
- Czech
- Swedish
- Italian
- Finnish
- Croatian
- Turkish
- Japanese
- Hebrew

_in preparation/not fully completed:_ Turkish, Croatian, Finnish

*videos - beta version*

The videos display cognitive biases and are aimed to assist group MCT.
Metacognitive Training (MCT)

Group Outline

• 2 x one hour sessions per week to teach material
• Between session homework/practice to master material

Training Modules:
1. Attribution: Blaming & Taking Credit
2. Jumping to Conclusions I
3. Changing Beliefs
4. Empathy I
5. Memory
6. Empathy II
7. Jumping to Conclusions II
8. Self-esteem and Mood
Understanding cognitive biases

Module 2

Target domains: Bias Against Disconfirmatory Evidence (BADE)/Jumping to Conclusions (JTC)

• Several alternative interpretations are provided.
• How likely is each option?
• Discuss your decision with your group members.
• smiling face
• bowl
• boat
• sled
• rocking chair
• elephant’s head
- smiling face
- bowl
- boat
- sled
- rocking chair
- elephant’s head
• smiling face
• bowl
• boat
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Metacognitive Training (MCT) Sample Exercises: Attributional Styles

When talking to your friend, you notice that he is not listening to you.
What caused your friend not to listen to you?

Who is to blame?

...myself I bore him; I am mumbling.

...others He is impolite; he may have problems.

...a situation The radio is on; he is distracted.

or chance
Studies show that many people with psychosis...

- tend to blame other people for negative events and failures
- tend to think that all events are beyond their own control

The first attributional style in particular may lead to interpersonal problems!
Skills acquired from MCT

- Learning to consider multiple explanations
- Looking for evidence that may help disprove a belief
- Take your time making a judgment when you’re uncertain.
- Recognize that our memories may be imperfect
- Work on self-esteem
Results and Participant responses

• “If I’m walking down the street and I hear a stranger swear, I might think the person is angry at me. However, maybe he’s having a bad day, on a cellphone, or talking to himself. Just because he said something, doesn’t mean it has anything to do with me but may be more to do with him or the situation or circumstance.”

• “Before when I observed someone laughing, I used to think that he was laughing at me. But without any evidence, I now realize, that I cannot jump to conclusions that the person is laughing at me. He may be laughing for many reasons; for example, sharing a joke with someone.”

• “By questioning myself, I can recognize symptoms more readily and see experiences from different angles rather than seeing only my point of view. MCT may not cure me, but it is a very useful wellness tool.”
Is it effective?

- MCT efficacy - a number of small studies and a couple of big trials
  - Two centre RCT comparing MCT and CRT
  - 75 patients in each group
Moritz et al (2014)- 3 year follow up data
Results and ongoing research

• In terms of research findings, MCT has been shown to improve positive symptoms (particularly delusions), prevent relapse and improve cognitive biases.

• We are recruiting participants for a five year CIHR funded study to examine the efficacy of MCT and cognitive remediation (CRT) on symptoms and social functioning, and understand brain mechanisms associated with change.

• If you have patients who might be interested in taking part in research studies on MCT/ CRT, please contact us at - cnos.lab@ubc.ca
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