Mind Wandering: A new perspective on ADHD

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MRC Social Genetic Developmental Psychiatry, Institute of Psychiatry, UK

MRC Social Genetic and Developmental Psychiatry
Outline of talk

- What is mind wandering and how is it described by people with ADHD
- The Mind Excessively Wandering Scale
- Theoretical models and implications for future studies
What is ADHD?

A persistent pattern of inattention or hyperactivity-impulsivity that interferes with or reduces the quality of functioning in daily life.
What is mind wandering?

Mind wandering occurs when one’s mind drifts away from a task and focuses on internal thoughts and images that are unrelated to the task or situation at hand.

Mind wandering is a universal human experience, representing 20-50% of our daily thinking time.
Mind Wandering in ADHD
“People with ADHD often struggle with filtering out”
Words used to describe mind wandering by adults with ADHD

Constant daydreaming
In a fog
A whirlwind of thoughts
Hamster on a wheel
Jack in the box
Waves in a storm
Pop corn
Bubbling-up

Asherson, Expert Review, 2005
Description of Excessive Mind Wandering in ADHD

“Cacophony of ideas”

“Layers and layers of this going on”

“Internal dialogue constantly going on ... I can’t stop it”

“Distracted by what is going on in my head”

“My mind is so active, I do not want to go to bed”
Why investigate MW in ADHD

- Multiple methods of measurement:
  - Rating scales
  - Experience sampling in daily life
  - Experience sampling during experimental paradigms

- Biomarker development
  - Diagnosis
  - Treatment response
  - Intermediate endophenotype (causal modelling required)

- Drug/treatment development
  - Real time monitoring of treatment effects
  - Treatment mechanisms (mediating effects)
  - Target for treatment (drugs, mindfulness training, neurofeedback, other)
Performing (cognitive) tasks
Performing (cognitive) tasks

Inattentive behaviour
Performing (cognitive) tasks

Inattentive behaviour

Sleep problems
Performing (cognitive) tasks

Sleep problems

Inattentive behaviour

Self-awareness and control of behaviour
Validation of the Mind Excessively Wandering Scale and the Relationship of Mind Wandering to Impairment in Adult ADHD

Florence D. Mowlem¹, Caroline Skirrow¹, Peter Reid¹, Stefanos Maltezos¹, Simrit K. Nijjar¹, Andrew Merwood¹,², Edward Barker¹, Ruth Cooper¹, Jonna Kuntsi¹, and Philip Asherson¹
Components of Excessive Mind Wandering in ADHD

• Thoughts on the go all the time

• Thoughts jumping of flitting from one topic to another

• Multiple lines of thoughts at the same time
The Excessively Mind Wandering Scale (MEWS)

1. I have difficulty controlling my thoughts
2. I find it hard to switch my thoughts off
3. I have two or more different thoughts going on at the same time
4. My thoughts are disorganised and ‘all over the place’
5. My thoughts are ‘on the go’ all the time
6. I experience ceaseless mental activity
7. I find it difficult to think about one thing without another thought entering my mind
8. I find my thoughts are distracting and prevent me from focusing on what I am doing
9. I have difficulty slowing my thoughts down and focusing on one thing at a time
10. I find it difficult to think clearly, as if my mind is in a fog
11. I find myself flitting back and forth between different thoughts
12. I can only focus my thoughts on one thing at a time with considerable effort

0 = Not at all / rarely; 1 = Some of the time;
2 = Most of the time; 3 = Nearly all of the time/constantly
Exploratory factor analyses

Study 1
(25 ADHD cases + 24 controls)

Study 2
(81 ADHD cases + 30 controls)

Single factor explains 63% to 70% of the variance in MEWS scores.

Mowlem, et al., JAD, 2016
Case-control differences

<table>
<thead>
<tr>
<th>Condition</th>
<th>AUC</th>
<th>Sensitivity</th>
<th>Specificity</th>
</tr>
</thead>
<tbody>
<tr>
<td>MEWS</td>
<td>.96</td>
<td>.90</td>
<td>.90</td>
</tr>
</tbody>
</table>

ROC (cut-off=15)
Polyserial Correlations between MEWS scores and ADHD symptoms and impairments scales

Mowlem, et al., JAD, 2016
Predictors of impairment (overall impairment score)

<table>
<thead>
<tr>
<th>Predictors</th>
<th>$R^2$</th>
<th>$R^2_{\Delta}$</th>
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<tbody>
<tr>
<td>Inattention + hyperactivity-impulsivity</td>
<td>.63**</td>
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* $p<.01$  
** $p<.0001$
## Predictors of impairment (overall impairment score)

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</tr>
<tr>
<td>Inattention alone</td>
<td>.25*</td>
<td></td>
</tr>
<tr>
<td>MW alone</td>
<td>.58**</td>
<td></td>
</tr>
<tr>
<td>Hyperactivity-impulsivity alone</td>
<td>.08</td>
<td></td>
</tr>
</tbody>
</table>

* $p<.01$
** $p<.0001$
Independent predictor of impairment
Controlling for inattention and hyperactivity-impulsivity

<table>
<thead>
<tr>
<th>Domain of impairment</th>
<th>$R^2$</th>
<th>$R^2 \Delta$</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Life Skills</td>
<td>0.44</td>
<td>0.18</td>
<td>&lt; 0.001</td>
</tr>
<tr>
<td>Self concept</td>
<td>0.21</td>
<td>0.10</td>
<td>&lt; 0.001</td>
</tr>
<tr>
<td>Social problems</td>
<td>0.22</td>
<td>0.14</td>
<td>&lt; 0.001</td>
</tr>
<tr>
<td>Risk taking</td>
<td>0.21</td>
<td>0.08</td>
<td>&lt; 0.01</td>
</tr>
</tbody>
</table>

Mind wandering carried the most importance in the model for all domains

Mowlem, et al., JAD, 2016
Impairments potentially linked to excessive mind wandering in ADHD

• Distracted from current tasks by internal thoughts
  o Difficulty following conversations
  o Holding thoughts in mind
  o Reading difficulties
  o Momentary lapses of attention
• Initial insomnia and disrupted sleep patterns
• Feeling fatigued by constant mental activity
• Distressed by constant mental restlessness
• Risk taking behaviour to reduce excessive MW
Mean Number of Task Unrelated Thoughts: in college students with childhood history of ADHD

- Experience sampling method
- Simple vigilance task: press for “x” but not “X”
- Report TUTs when computer beeps (for period between beeps)
  - Spontaneous TUTs (thoughts unrelated to task ‘pop into your mind’)
  - Deliberate TUTs (purposely think of something unrelated to task)

Shaw and Giambra, Developmental Neuropsychology, 1993
Spontaneous MW associated with ADHD diagnosis and ASRS scores

Seli, Smallwood, Cheyne, Smilek 2015, Psychonomic Bulletin and review
Default Mode Network

THE BRAIN IN NEUTRAL

When you switch off, a distinctive network of brain areas not involved in focused attention bursts into action.

- Default network
- Areas involved in focused visual attention
Task Unrelated Thoughts (TUTs) correlate with task induced deactivation (TIDs) of default mode regions

Regions where TUTs correlate with TIDs

Anterior Cingulate/superior frontal gyrus
Middle frontal gyrus, Fusiform gyrus
Posterior Parietal Occipital cortex

McKiernan et al., Neuroimage, 2006
Established high incidence mind wandering periods by training people on blocks of visuospatial working memory tasks (days 1-4)

Increased DMN activity was associated with *practiced blocks* compared to *novel blocks* – indirectly evaluating periods of excessive mind wandering (day 4)

Patients reported more Task Unrelated Thoughts (TUTs) during practiced than novel blocks (day 4)

Patterns of DMN activity correlated with patients self-reported *propensity* to generate TUTs (using *Daydream frequency scale*)
Regions of the DMN showing greater activity during practiced blocks relative to novel blocks (P<.001)

A: Right medial Pre-frontal cortex
B: Bilateral cingulate cortex
C: Right Insula
D: Left posterior cingulate

Mason et al., Science, 2007
Regions of the DMN show significant correlation between frequency of TUTs and TIDs – contrasting practiced versus novel blocks

A: Bilateral Medial prefrontal cortex; B: Bilateral precuneus; C: Right cingulate; D: Left insula; E: Right insula

Mason et al., Science, 2007
DMN activity related to TUTs measured using experience sampling in the scanner.

Christoff, Gordon, Smallwood et al., PNAS, 2009
Contrasting periods of **Task Unrelated Thoughts** versus periods of **Task Related Thoughts**

A: Dorsal anterior cingulate gyrus  
B: Ventral anterior cingulate gyrus  
C: Precuneus  
D: Bilateral temporo-parietal junction  
E: Bilateral dorsolateral prefrontal cortex

Both DMN and EF networks recruited during MW.

Christoff, Gordon, Smallwood et al., PNAS, 2009
Greater activation during periods of being unaware that the mind had wandered.

Christoff, Gordon, Smallwood et al., PNAS, 2009
<table>
<thead>
<tr>
<th>Study</th>
<th>Analysis</th>
<th>Peak foci</th>
<th>Design</th>
<th>N</th>
<th>Mind-wandering measure</th>
<th>Spontaneous thought type</th>
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<tbody>
<tr>
<td>McGuire et al. (1996)</td>
<td>WB &amp; ROI</td>
<td>5</td>
<td>Blocked</td>
<td>5/6</td>
<td>Retrospective</td>
<td>Verbal stimulus-independent thoughts during rest</td>
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<tr>
<td>Binder et al. (1999)</td>
<td>WB</td>
<td>8</td>
<td>Blocked</td>
<td>14</td>
<td>Inferential</td>
<td>Task-unrelated thought during rest</td>
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<td>Christoff et al. (2004)</td>
<td>WB</td>
<td>2</td>
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<td>12</td>
<td>Assumptive</td>
<td>Spontaneous thought during rest</td>
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<td>D'Argembeau et al. (2005)</td>
<td>WB</td>
<td>9</td>
<td>Blocked</td>
<td>13</td>
<td>Retrospective</td>
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<td>McKiernan et al. (2006)</td>
<td>ROI</td>
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<td>Blocked</td>
<td>30</td>
<td>Inferential</td>
<td>Task-unrelated thought during auditory task</td>
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<td>Spiers &amp; Maguire (2006b)</td>
<td>WB &amp; ROI</td>
<td>24</td>
<td>ER</td>
<td>20</td>
<td>Retrospective (Online)</td>
<td>Spontaneous mentalizing during navigation task</td>
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<td>Mason et al. (2007)</td>
<td>WB resting state → Functionally-defined ROIs</td>
<td>20</td>
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<td>19</td>
<td>Inferential and Questionnaire</td>
<td>Mind-wandering during highly practiced task</td>
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<td>Christoff et al. (2009)</td>
<td>WB</td>
<td>34</td>
<td>ER</td>
<td>15</td>
<td>Online</td>
<td>Mind-wandering during SART</td>
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<tr>
<td>Wang et al. (2009)</td>
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<td>Questionnaire</td>
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<td>Andrews-Hanna et al. (2010a)</td>
<td>ROI; seed-based FC</td>
<td>–</td>
<td>Blocked</td>
<td>30/139</td>
<td>Surprise retrospective</td>
<td>Spontaneous thought during passive fixation</td>
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<td>Dumontheil et al. (2010)</td>
<td>WB</td>
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<td>16</td>
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<td>Task-unrelated thought during various simple tasks</td>
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<td>Stawarczyk et al. (2011b)</td>
<td>ROI/Supp. WB</td>
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<td>ER</td>
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<td>Online</td>
<td>Mind-wandering during SART</td>
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<tr>
<td>Vanhaudenhuysse et al. (2011)</td>
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<td>ER</td>
<td>22</td>
<td>Online</td>
<td>Intensity of internal awareness during rest</td>
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<tr>
<td>Christoff (2012)</td>
<td>ROI; seed-based FC</td>
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<td>ER</td>
<td>15</td>
<td>Online</td>
<td>Mind-wandering during SART</td>
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<td>Hasenkamp et al. (2012)</td>
<td>WB</td>
<td>–</td>
<td>ER</td>
<td>14</td>
<td>Online</td>
<td>Mind-wandering during meditation</td>
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<td>Hasenkamp and Barsalou (2012)</td>
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<td>Allen et al. (2013)</td>
<td>ROI</td>
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<td>Online</td>
<td>Task-unrelated thought during EAT</td>
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<tr>
<td>Kucyi et al. (2013)</td>
<td>WB</td>
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<td>Blocked</td>
<td>51</td>
<td>Online</td>
<td>Mind-wandering during painful stimuli</td>
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<td>Moss et al. (2013)</td>
<td>Functional localizer-defined ROIs</td>
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<td>WB</td>
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<td>16</td>
<td>Assumptive</td>
<td>Stimulus-independent thought during various tasks</td>
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<td>Smallwood et al. (2013a)</td>
<td>ROI</td>
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<td>42</td>
<td>Online</td>
<td>Mind-wandering during reading</td>
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<td>Gorgolewski et al. (2014)</td>
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<td>Blocked</td>
<td>166</td>
<td>Retrospective</td>
<td>Self-generated thought during rest</td>
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<td>Kucyi and Davis (2014)</td>
<td>ROI</td>
<td>–</td>
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<td>51</td>
<td>Online</td>
<td>Mind-wandering during painful stimuli</td>
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<td>Tusche et al. (2014)</td>
<td>ROI</td>
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<td>ER</td>
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<td>Online</td>
<td>Self-generated thought during rest</td>
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Fox et al., 2015
Meta-analysis of functional neuroimaging studies of mind-wandering and related spontaneous thought processes (Fox et al., 2015)
Does mind wandering reflect executive functioning or executive failure

Mind wandering utilises executive resources
- As task demands increase, MW decreases
- MW increases on practiced tasks, driving

**Deliberate Mind Wandering**

Mind wandering occurs as a failure of executive control
- MW occurs when executive processes fail to suppress interference from off task thoughts
- Reducing executive resources (e.g. alcohol, sleep) leads to increased MW

**Spontaneous mind wandering**

Parallel characteristics of behavioural and neural regulation in ADHD and MW

- Context regulation
- Salience and reward
- Sensory decoupling
- Overlapping functional impairments
Context regulation of MW

Choice Reaction Time Task (low demand)
- Sequence of black digits
- Coloured digit – then indicate the parity of the digit (+/-)

1-back Working Memory Task (High demand)
- Sequence of black digits
- Coloured digit – then indicate the parity of the previous digit

Task Unrelated Thoughts measured every minute using thought probes

Results: Greater MW in low demand compared to high demand task (p<.001)

Bernhardt et al. 2013; Baird et al., 2012
Increasing task demands decreased mind wandering in controls

B.C. Bernhardt et al. / NeuroImage 90 (2014) 290–297
Normalisation of frontal theta activity following methylphenidate treatment in ADHD

Midline frontal theta is strongly anti-correlated with DMN activity (e.g. White et al., 2012, Michels et al., 2012)

Skirrow et al., 2014, European Neuropsychopharmacology
Flanker Task: Significant group by congruency interaction where ADHD did not show a change in mean and variability of theta amplitude between conditions, compared to controls (p<.01)
The impact of increasing demands on sustained attention in ADHD and ASD: an fMRI investigation

Chistakou et al., 2013
The salience network: Role in the relative salience of stimuli to capture attention

Uddin L.Q. 2014, Nature Reviews Neuroscience
Incentives improve Reaction Time Variability (RTV) in ADHD

Andreou et al. (2007)
Psychological Medicine
Ventral-striatal responsiveness during reward anticipation in ADHD: metaanalysis of fMRI studies

Plichta & Scheres, Neurosci Biobehav Rev 2014; 38: 125-34
Effects of methylphenidate and motivation on default mode network deactivation

Liddle et al., JCCP, 2011
Effects of methylphenidate and motivation on default mode network deactivation

Liddle et al., JCCP, 2011
Effects of methylphenidate and motivation on default mode network deactivation
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Liddle et al., JCCP, 2011
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Liddle et al., JCCP, 2011
Effects of methylphenidate and motivation on default mode network deactivation

ADHD off methylphenidate

ADHD on methylphenidate

High Incentive

Weighted mean betas

Low Incentive

High Incentive

Liddle et al., JCCP, 2011
"Using brain imaging, we have been able to see inside the children's heads and observe what it is about ADHD that is stopping them concentrating. Most people are able to control their 'daydreaming' state and focus on the task at hand. This is not the case with children with ADHD. If a task is not sufficiently interesting, they cannot switch off their background brain activity and they are easily distracted. Making a task more interesting -- or providing methylphenidate -- turns down the volume and allows them to concentrate."
Just now, were you thinking about anything unrelated to the task?

(1) YES  (2) NO

Baird et al., 2014, J Cog Neurosci.
MW and sensory decoupling

A. STIM. → Task Focus (TF)

B. Mind-wandering (MW)

C. PLF [4–7 Hz]

D. FDR (α = 5%)

E. 50 msec, 150 msec, 250 msec
Early visual processing of no-go stimuli in adults with ADHD and controls

Post-hoc analyses:
• P1 peak amplitude for no-go stimuli was attenuated for cases compared to controls at Oz, $p=0.019$

• No case-control differences in mean amplitude or peak latency.

 Controls
100 ms post no-go stimuli

 ADHD
100 ms post no-go stimuli

Bozhilova et al., unpublished data
Early visual processing of no-go stimuli preceding a correctly withheld response or a response (error) in ADHD cases

Post hoc analyses:
• Both peak and mean amplitude P1 were larger at PO9 for the correct condition compared to the error condition, p=0.001, p=0.008

Error response
100 ms post no-go stimuli preceding an erroneous response

Correct response
100 ms post no-go stimuli preceding a correctly withheld response

Bozhihlova et al., unpublished data
Key findings from ADHD follow-up study

- Preparation-vigilance measures were markers of remission, improving concurrently with ADHD symptoms.

- The strongest candidates for the development of non-pharmacological interventions involving cognitive training and neurofeedback.

- Executive control measures of inhibition and working memory were not sensitive to ADHD persistence / remission.

Cheung et al. (2015)
*British Journal of Psychiatry*
Default mode network: marker of remission

Reduced positive posterior cingulate – medial prefrontal cortex connectivity in **persistent ADHD only**:

- Indicates default mode network (DMN*) dysfunction as a marker of remission

- DMN dysfunction has been associated with high RTV (e.g. Kelly et al. 2008); *both* are markers of remission

* DMN – comprised of brain regions typically more activated during rest than task performance
Plausible causal chain

Task induced deactivation

Task unrelated thoughts

ADHD symptoms, cognitive deficits

Functional impairments
Mind Full, or Mindful?
Thanks!

Florence Mowlem
Caroline Skirrow
Peter Reid
Andrew Merwood
Jonathan Smallwood
Celine Ryckaert
Ruth Cooper
Grainne McLoughlin
Stefanos Maltezos and the SLAM Maudsley ADHD clinic team
Jonna Kuntsi

Social Genetic and Developmental Psychiatry, Institute of Psychiatry
Psychology and Neuroscience, King’s College London
National Institute of Health Research
Action Medical Research
Vifor Pharma
GW Pharma
Janssen-Cilag
Research participants
Mind wandering as spontaneous thought: a dynamic framework model

Christoff et al., Nature Reviews Neuroscience, 2016
Just now, were you thinking about anything unrelated to the task?

(1) YES  (2) NO

STIM. 2 ○ 6 ○ 3  

Target  

SOA: 2400–2900 msec

Probe
• Delayed P100 and lower P100-NoGo amplitude in ADHD.
• Source of P100 was located in occipital area.
• A sizable decrease in early electrical activity was found in ADHD, especially in the NoGo condition.

Suggests an early deficit in visual sensory integration within the occipital cortex in children with ADHD.
Reduced early somatosensory processing following stimulation of the median nerve

Dockstander,....Tannock, et al., 2008, Behavioural and Brain Functions
Case-control differences for Impairment scores

Mowlem, et al., JAD, 2016

All p<.0001
History of excessive mind wandering in ADHD

• Crichton (1798): Attentional problems including *mental restlessness*

• Giambra (1989): *Task Unrelated Thoughts* are produced in an inverse relationship to age.

• Shaw and Giambra (1993): Students with a history of hyperactivity (ADHD) reported more *Task Unrelated* and *Intrusive* thoughts

• Mannuzza (1991): Linked drug and alcohol abuse in ADHD, to the wish to “stop the discomfort of unbidden thoughts”

• Nadeau (1997): Adults with ADHD have difficulty with *internal distractions* such as *daydreaming* and *constant flow of thoughts*
History of excessive mind wandering in ADHD

- Downey (1997): Difficulty sustaining attention and mental restlessness were the most common symptoms in adult ADHD.

- Conners (1999): Four factor model. Hyperactivity/restlessness factor consisted of items reflecting cognitive and physical restlessness.

- Healy (2000): College students with ADHD rated themselves as having more difficulty paying attention and having distracted thoughts during lectures.

- Silver (2000): Young adults with ADHD had problems with internal distractibility.
Average Task Unrelated Thoughts (TUTs) and Task Induced Deactivations (TIDs)

Auditory Detection Task:

Manipulated task conditions
- Presentation rate
- Target discriminability
- Short term memory load

McKiernan et al., Neuroimage, 2006
Mindfulness In ADHD (MIA) – feasibility study

10 participants:
- Change in Inattention: p < .02
- Change in MEWS: p < .01
- Change in Hyperactivity: ns

Changes score correlations:
- MEWS-Inattention: r = .75, p < .02
- MEWS-Hyper: ns

Asherson et al.; Unpublished data
Table 2. Differences Between Groups at the End of Treatment, Controlling for Baseline Levels.

<table>
<thead>
<tr>
<th></th>
<th>Baseline</th>
<th></th>
<th>End of treatment</th>
<th></th>
<th>End of treatment</th>
<th>Group difference [95% CI]</th>
<th>Cohen’s d type</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>MBCT</td>
<td>WL</td>
<td>MBCT</td>
<td>WL</td>
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<tr>
<td>ADHD symptoms, CAARS</td>
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<tr>
<td>Investigator (n = 68)</td>
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<tr>
<td>Inattention</td>
<td>16.3 (4.7)</td>
<td>17.0 (4.5)</td>
<td>12.4 (4.6)</td>
<td>16.5 (4.2)</td>
<td>-3.6 [-5.5, -1.8]**</td>
<td>0.78</td>
<td></td>
</tr>
<tr>
<td>Hyperactive-impulsive</td>
<td>13.0 (5.6)</td>
<td>12.0 (4.8)</td>
<td>9.0 (4.6)</td>
<td>11.5 (5.3)</td>
<td>-3.2 [-5.0, -1.4]**</td>
<td>0.62</td>
<td></td>
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<tr>
<td>Total score</td>
<td>29.3 (8.7)</td>
<td>29.0 (7.1)</td>
<td>21.5 (7.7)</td>
<td>28.0 (7.5)</td>
<td>-6.7 [-9.8, -3.6]**</td>
<td>0.85</td>
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<td>Self report (n = 74)</td>
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<tr>
<td>Inattention</td>
<td>15.4 (3.9)</td>
<td>16.6 (4.5)</td>
<td>12.8 (4.2)</td>
<td>16.1 (3.8)</td>
<td>-2.7 [-4.3, -1.2]**</td>
<td>0.64</td>
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<tr>
<td>Hyperactive-impulsive</td>
<td>12.8 (4.8)</td>
<td>13.6 (4.5)</td>
<td>10.3 (4.2)</td>
<td>12.6 (5.0)</td>
<td>-1.8 [-3.4, -0.2]**</td>
<td>0.39</td>
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<tr>
<td>Total score</td>
<td>28.2 (7.0)</td>
<td>30.2 (6.5)</td>
<td>23.0 (7.3)</td>
<td>28.8 (6.9)</td>
<td>-4.5 [-7.3, -1.8]**</td>
<td>0.67</td>
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<tr>
<td>EF, BRIEF-ASR (n = 74)</td>
<td></td>
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<tr>
<td>Inhibit</td>
<td>17.2 (3.3)</td>
<td>18.2 (2.6)</td>
<td>14.7 (3.1)</td>
<td>17.4 (3.2)</td>
<td>-2.1 [-3.3, -0.9]**</td>
<td>0.71</td>
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<tr>
<td>Shift (n = 62)</td>
<td>12.6 (2.9)</td>
<td>12.5 (2.5)</td>
<td>11.1 (3.0)</td>
<td>12.3 (3.0)</td>
<td>-1.3 [-2.2, -0.3]**</td>
<td>0.48</td>
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<tr>
<td>Emotional control</td>
<td>19.5 (5.1)</td>
<td>19.1 (5.1)</td>
<td>17.1 (4.7)</td>
<td>18.8 (4.9)</td>
<td>-2.2 [-3.8, -0.6]**</td>
<td>0.43</td>
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<tr>
<td>Self-monitor</td>
<td>11.4 (2.7)</td>
<td>11.4 (2.8)</td>
<td>10.1 (2.5)</td>
<td>11.3 (2.8)</td>
<td>-1.3 [-2.3, -0.3]**</td>
<td>0.47</td>
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<tr>
<td>Initiate</td>
<td>17.4 (3.9)</td>
<td>18.4 (3.2)</td>
<td>15.7 (4.4)</td>
<td>18.1 (2.9)</td>
<td>-1.6 [-2.8, -0.4]**</td>
<td>0.45</td>
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<tr>
<td>Working memory</td>
<td>19.4 (3.0)</td>
<td>19.8 (2.2)</td>
<td>17.2 (3.4)</td>
<td>19.2 (2.6)</td>
<td>-1.7 [-2.9, -0.5]**</td>
<td>0.65</td>
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<tr>
<td>Plan/organize</td>
<td>23.0 (4.0)</td>
<td>24.5 (3.6)</td>
<td>19.8 (4.9)</td>
<td>24.1 (3.5)</td>
<td>-3.1 [-4.7, -1.5]**</td>
<td>0.82</td>
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<td>Task monitor</td>
<td>13.1 (2.6)</td>
<td>13.7 (2.3)</td>
<td>11.6 (2.4)</td>
<td>13.5 (2.6)</td>
<td>-1.5 [-2.4, -0.6]**</td>
<td>0.61</td>
<td></td>
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<tr>
<td>Organization of materials</td>
<td>17.6 (4.2)</td>
<td>19.1 (3.6)</td>
<td>15.1 (4.2)</td>
<td>18.8 (4.1)</td>
<td>-2.4 [-3.5, -1.2]**</td>
<td>0.62</td>
<td></td>
</tr>
<tr>
<td>Total score</td>
<td>150.3 (22.2)</td>
<td>156.7 (17.2)</td>
<td>132.2 (26.4)</td>
<td>153.8 (18.8)</td>
<td>-18.4 [-26.6, -10.1]**</td>
<td>0.93</td>
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</tr>
</tbody>
</table>
### Meta-analysis of Mindfulness Based Interventions in ADHD

**Figure 1.** Primary analysis of inattention. 
*Note. CI = confidence interval.*

**Figure 2.** Primary analysis of hyperactivity/impulsivity. 
*Note. CI = confidence interval.*

\[ d = 0.66 \ (0.40 - 0.92) \]

\[ d = 0.53 \ (0.32 - 0.74) \]
Everyone’s mind wanders, but we all do it to a different degree, so what is its impact?

Tinyurl.com/mindwander

Link can be found on twitter @FloMowlem

Contact: Florence Mowlem for more information
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