From genes to social context: Understanding and treating stuttering

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Many different causes of handicap

- Genetic component
- Neuro-biological anatomical differences
- Brain chemicals
- Differences in brain functions
- Conditioning: association of fear and stuttering to situations and people
- Learned behaviours: secondary symptoms
- Mal-adaptive thoughts: “I shouldn’t talk”, “I can’t do this because of stuttering”, ....
- Acceptance of social environment
- Job Market: reaction to stuttering

Many different treatment options

- Protein replacement (in the future?)
- Pharmaceutical
- De-conditioning through exposure: learn to un-learn fear of speaking situations
- Re-shape secondary symptoms: keep eye contact, reduce fillers, avoid avoidance
- Fluency shaping, stuttering modification.
- Cognitive therapy: change your beliefs: “I have the right to talk”, “Stuttering is not holding me back”, ....
- Informing and shaping your social environment
- Job Market: change reaction to stuttering

For a clear picture, we need

1) a holistic framework to classify and manage human complexity.

and

2) a generic theory of stuttering catering for
   - sub-types of the biological basis for stuttering.
   - all drivers of symptom and handicap.

Let us derive our basic model of the human system
The standard answer is “the biopsychosocial model”

Engel (1977)

Disorders affect all three, which affect disorders. Consider the three whenever you deal with humans.

A biopsychosocial view on stuttering

PSYCHO
SOCIAL
BIO

GENE
FIBER STRUCTURE
BASAL GANGLIA
NEUROTRANSMITTER
NEGATIVE ASSOCIATIONS
LEARNED HELPLESSNESS
NEGATIVE THOUGHTS
ENVIRONMENTAL STRESS (WORK PLACE)
SOCIAL ISOLATION

Superficial Approach: What states drive the processes?

Final States are driving biological processes.

Is a social or psycho state causing this? Is it not affecting all three states?

DERIVE AND USE A CONCRETE BIOPSYCHOSOCIAL FRAMEWORK

Step 1: Slice physical world

The world is filled with matter obeying physical laws. We slice and model the world into the external and internal of the organism. At each moment, both are in a certain physical state.

Step 2: Split body and stored information

Biological system that learns (adapts to environment) by storing info based on environmental interactions and internal processes. At each moment, memories and body are in a certain physical state.
Where is social isolation?

“John has very little social interactions.”
– A process but not a physical element of environment.
– The process could be influenced by different states in
  • Environment (People with memories “Avoid John!”)
  • Body (autism)
  • Memories (“I don’t want to talk to people inferior to me”)

Communicable memories (memes)

• Concepts: parent, sea, physics, TV, bridge, password.
• Knowledge/Belief: password is XYZ, my Name is Z, water freezes at 0°Celsius.
• Scripts: how to tie laces, how to greet, how to date. (note: not the motor code but verbal instructions)
• Labels: social labelling of sensori-motor memory, e.g. labeling the colour of red as “red”.

10’000s of memes (communicable memory) inside our head.

Confined memory (A.M.E.s)

Associations: a spider phobia, Pavlov effect.
Stimulus A ~ Stimulus B due to pairing (not to be confused with association between concepts)

Motor Code: walking and articulating vowels.

Episodes (or sensory memory): face of mother, taste of chocolate, smell of cheese, sound of bell.

Test: Ame or Meme or Both?

• “My grand-father is called Kelly”
• The face of my teacher
• “I was in Rome”
• The smell of cheese
• “When I see a spider, I have panic.”
• “I fear spiders.”
• Ten-finger typing

The human system divides into four domains again divided up in thousands of elements

<table>
<thead>
<tr>
<th>Memories</th>
<th>Body</th>
<th>Environment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Meme 1</td>
<td>AME 1</td>
<td>Body 1</td>
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<tr>
<td>Meme 2</td>
<td>AME 2</td>
<td>Body 2</td>
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<tr>
<td>Meme 3</td>
<td>AME 3</td>
<td>Body 3</td>
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<tr>
<td>Meme 4</td>
<td>AME 4</td>
<td>Body 4</td>
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<tr>
<td>Memme 5</td>
<td>AME 5</td>
<td>Body 5</td>
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<td>Memme 6</td>
<td>AME 6</td>
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<td>Memme 7</td>
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<td>Memme 8</td>
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<td>Memme 9</td>
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<td>Memme 10</td>
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<td>Memme 11</td>
<td>AME 11</td>
<td>Body 11</td>
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<td>Memme 12</td>
<td>AME 12</td>
<td>Body 12</td>
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<tr>
<td>Memme 13</td>
<td>AME 13</td>
<td>Body 13</td>
</tr>
<tr>
<td>Memme 14</td>
<td>AME 14</td>
<td>Body 14</td>
</tr>
<tr>
<td>..........</td>
<td>........</td>
<td>........</td>
</tr>
</tbody>
</table>

Two types of stored information based
1. communicable memories, via language and other means.
2. confined memories, learned individually.
(e.g. the concept of juggling versus the skill of juggling.)
Dual perspective: processes - states

Overlapping fuzzy influences

strictly separate physical domains

Why does she eat ice cream?
EXAMPLE ON WHICH ELEMENTS IN THE FOUR DOMAINS DRIVE THIS

Elements driving “eating ice cream”

Memories
"Eat ice cream when sunny."
Meme 2
Meme 3
Meme 4
Meme 5
“Vanilla is my favourite.”
Meme 7
Meme 8
Meme 9
“Ice cream is cold.”

Body
AME 1
AME 2
AME 3
AME 5
AME 6
AME 7
AME 9
AME 10
AME 11
AME 13
AME 14

Environment
Env 1
Env 2
Env 4
Env 6
Env 7
Env 9
Env 10
Env 12
Env 13
Env 14

Taste of vanilla
AME 5
AME 7

Body
AME 6
Body 2
Body 3
Body 4
Blood sugar
AME 8

“Empty” stomach
Body 10
Body 11
Body 12
Body 13
Body 14

Ice cream
AME 12

GENERIC THEORY OF STUTTERING

NDC-4 is holistic framework for scientific theories on stuttering

Neurobiological Demand and Capacity model
(hide complexity of causal subtypes)

4-domain biopsychosocial framework
(acknowledging the re-enforcing adaptive learning)
(the topic of an up-coming book)

All share dysfunction in performance
Stutterers might vary in causes and symptoms, but
"All have moments where they know exactly what they want to say but cannot actually say it."

"Those moments are abnormally frequent and the duration of the jam is abnormally long."

"They have moments where they can say exactly what they want to say at the moment they want to say it."
Think neurological demand and capacity

Speech system has an abnormally low capacity unable to cope with normal high neurological demands

Permanent neurobiological deficit leads to biopsychosocial adaptation

Permanent deficit in one affects others!

Many causes to one dysfunction to many symptoms

Gene A
Gene B
Virus
Gene A + B
Blow to head
Gene D
Gene G + trauma
Gene E + male
Develop Issue A
Develop Issue D

SUBTYPE 1
SUBTYPE 2
SUBTYPE 3
SUBTYPE 4
SUBTYPE 5
SUBTYPE 6

Demand / capacity
Jamming / stress

Long pause
Block
Repetition
Filler
Stop
Switch words
Stress

Example of developmental stuttering

From a neurobiological deficit to full-blown stuttering symptoms

BODY: the low capacity leads to stuttering

AME are created as kid adapts

Low capacity speech system

The low capacity system in the bio system jams at high demand and creates stuttering behaviour and experiences of stuttering.

Stuttering behaviours and experiences from jamming in biological system creates associations, motor codes, and episodes. While low capacity system keeps on jamming!
ENVIRONMENT changes

Parents react
Parents set norms
Friend teases

Associates “d” to blocks
Leans tensing up at block & speak fast when fluently
Episodes of blocking publicly

Low capacity speech system

The associations, motor code, and episode are fueling the stuttering behaviors and experiences with primary and secondary stuttering on top of the jamming. All of this has an impact on the environment.

Beliefs are created as kid adapts

Parents react
Parents set norms
Friend teases

Associates “d” to blocks
Leans tensing up at block & speak fast when fluently
Episodes of blocking publicly

Norm of ideal speech (parents / friends).
I must hide my stuttering
I have no girlfriend due to my stuttering

Unstable speech system

The kid/teenager/adult processes the stuttering behaviors and experiences cognitively and holds certain false beliefs that makes the handicap greater and fuels stuttering behaviors further.

TREATMENT SCHEME

HOW TO UNDERSTAND AND TREAT DISORDERS HOLISTICALLY

Biological, psychological, and social processes describe changes of physical states

Treat=Change state to change B&E

Initial state
WHICH TREATMENT?

Desired process?

Target state

Processes happening in time
CASE STUDY: STUTTERING

STUTTERING
1. John has been stuttering since the age of three. His mother and maternal uncle also stutter.
2. His stuttering is moderate, and everyone understands him easily despite his stuttering.
3. He is terrified talking in front of other people, and still remembers the laughter at school.
4. He is more relaxed with friends and family, even though he still stutters.
5. Some weeks he finds speaking easier, and in some weeks he is struggling much more. But he is always stressed about stuttering publicly.
6. He fears certain words that start with /d/, and avoids those words whenever possible.
7. Once he did an intensive three-week course, came out very fluent, and relapsed after a few months much to his disappointment. John blames himself for his failure.
8. John is an IT specialist. His boss offered him a promotion but he would need to give public presentations. John refuses, which leaves him frustrated and depressed.

What are the different options that could potentially increase John’s well being?
## Intervention Matrix

Rank intervention methods according to impact and changeability in order to prioritize intervention.

<table>
<thead>
<tr>
<th>IMPACT</th>
<th>CHANGEABILITY</th>
<th>HIGH</th>
<th>LOW</th>
</tr>
</thead>
<tbody>
<tr>
<td>HIGH</td>
<td>gradual desensitization, flooding, role play, hypnotherapy, contains list to go to self-help group</td>
<td></td>
<td></td>
</tr>
<tr>
<td>LOW</td>
<td>self-help group, anti-stress (stress-relaxation, meditation, sports, medication)</td>
<td>beta-blockers</td>
<td></td>
</tr>
<tr>
<td>LOW</td>
<td></td>
<td></td>
<td>pharmaceuticals</td>
</tr>
</tbody>
</table>