Complex Networks and Measures of Psychosis

Speech Graphs Provide a Quantitative Measure of Thought Disorder in Psychosis

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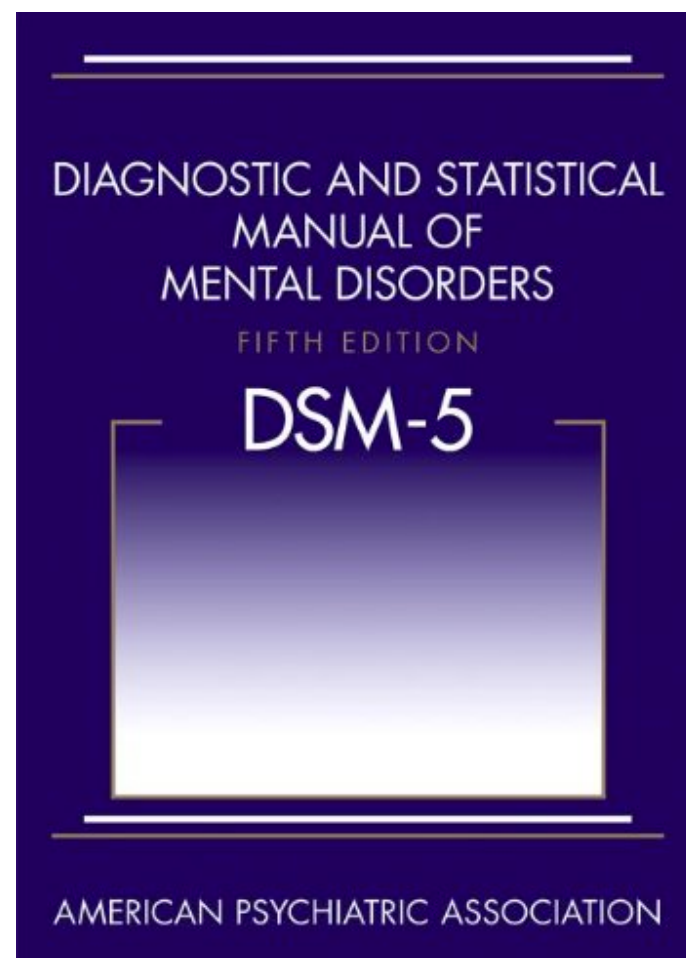
What is Psychosis?

- Psychosis: loss of contact with reality.

- Can arise from schizophrenia or mania.

- Schizophrenia: failure to understand what is real.

- Mania: abnormally elevated state of arousal, mood or energy level
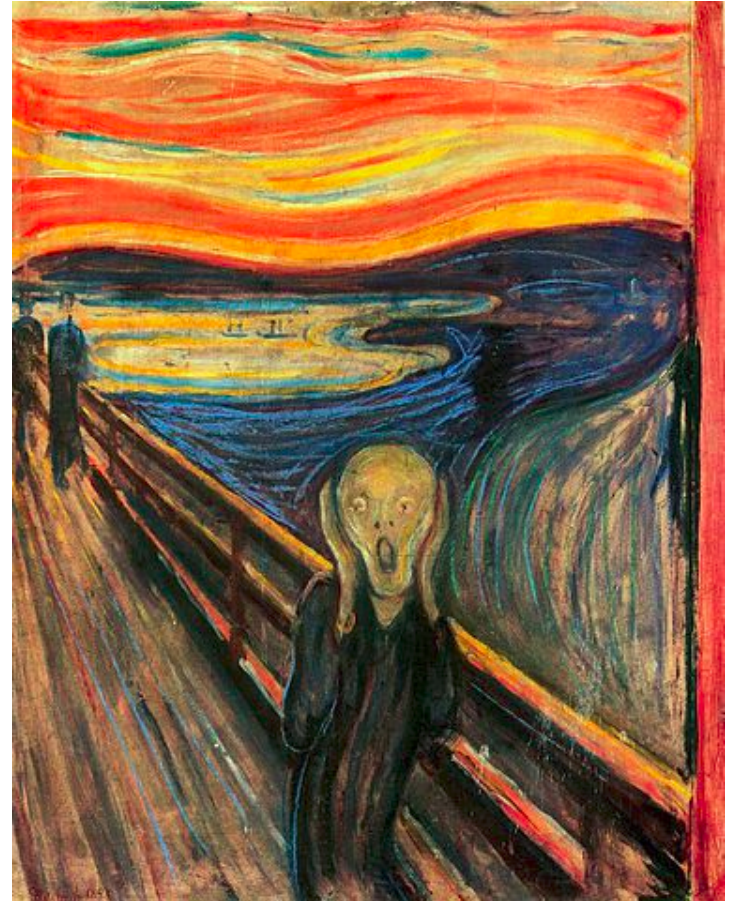
Problems with diagnosis?

- Look for symptoms

- Relies on psychiatric interviews

- Qualitative analysis of body and verbal language

- Common criticisms:
  - Too qualitative
  - Not very scientific
  - Too subjective

DIAGNOSTIC AND STATISTICAL MANUAL OF MENTAL DISORDERS

FIFTH EDITION

DSM-5

AMERICAN PSYCHIATRIC ASSOCIATION

Solution: Complex Networks

- Quantitative Speech Analysis.
- Subjects were asked to talk about a dream.
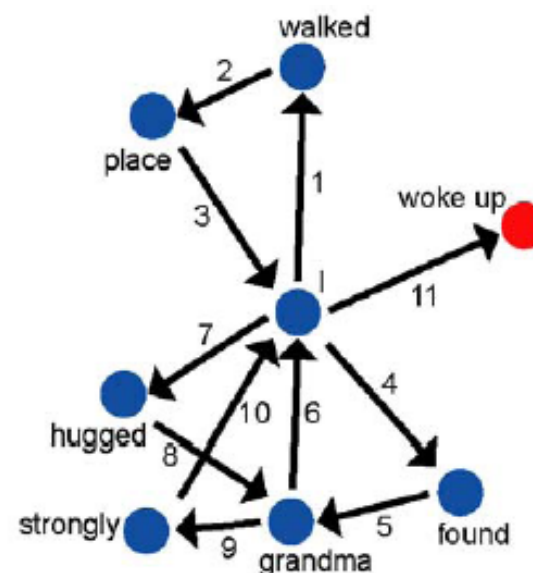
Quantitative Speech Analysis

- Networks are directed
- Self-loops allowed
- Multiple edges allowed
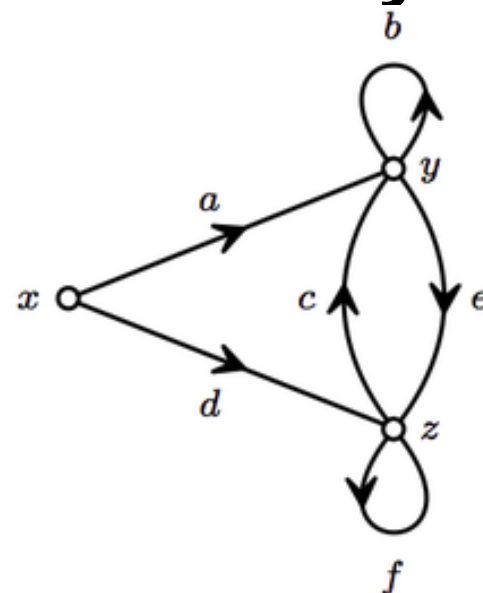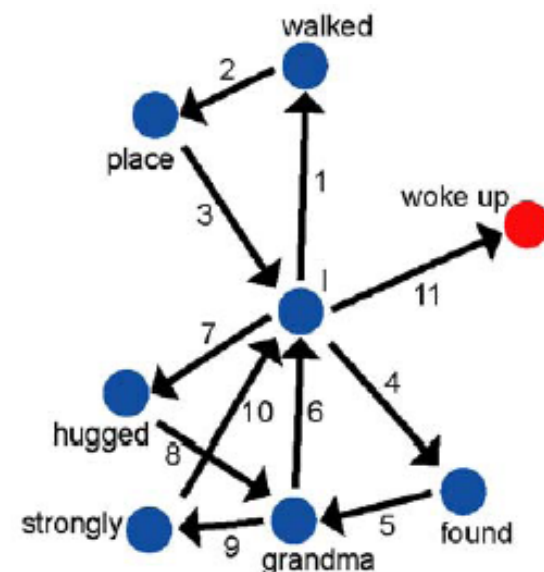
Types of Psychoses studied

Schizophrenia

not
saw
Jesus
sometimes
for me
laughing
daughter
appears
Gospel
crying

Control

ok
alone
could
leave
stirring
I
dream
went
remained
way
water
slipped
fell
barrier

Mania

buy
offered
said
woke up
who
know
give
dreamed
fix
shopping
worked
suddenly
sell
people
cement
did
carpet
needed
went
corner
time
reached
don't want
tied
need
walked
had
mare
took
money
possessed
two hours
pocketful
boy
strained
godfather
was
remained
never liked
work
my
first
commitment
week
family
assumed

Measures

- – Number of Nodes
- – Number of Edges
- – Size of largest component
- – Number of edges of largest component
- – Average total degree
- – Number of parallel edges
- – Number of loops with 1, 2 and 3 nodes
- – Number of waking nodes and edges
- – Diameter
- – Average shortest path between pairs of nodes
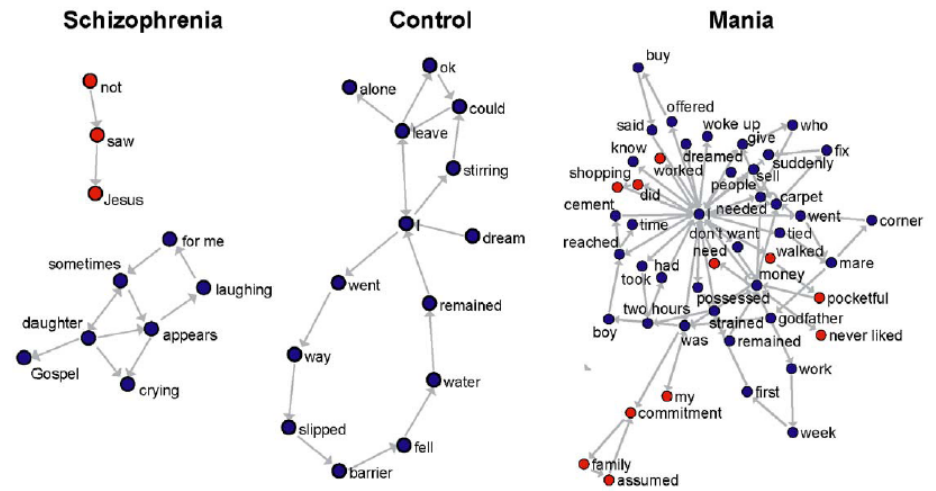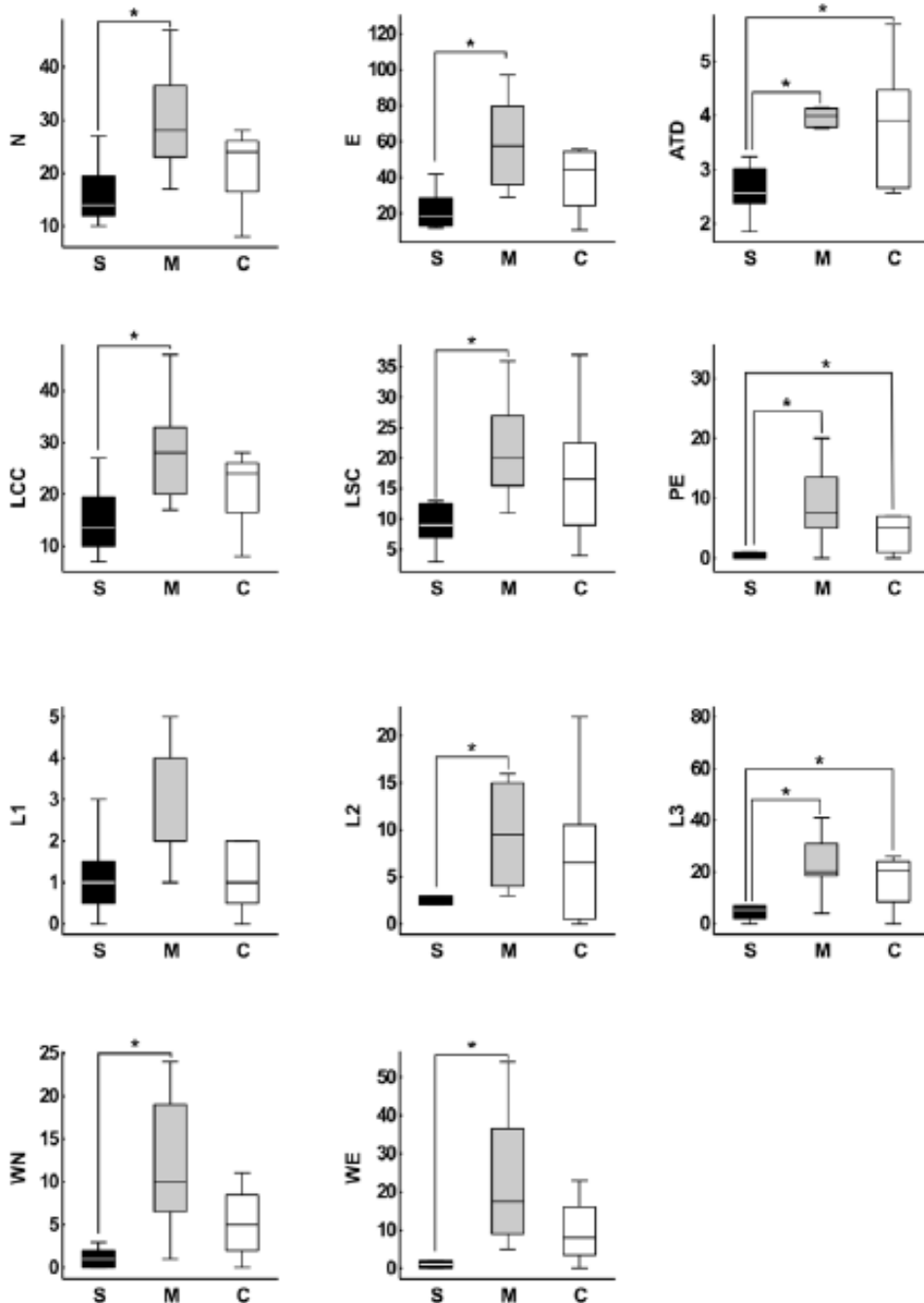
- N: Number of Nodes
- E: Number of Edges
- ATD: Average total degree $\langle k \rangle$
- LLC: Size of largest component
- PE: Number of parallel edges
- L1, L2, L3: Number of loops with 1, 2 and 3 nodes
- WN: Number of waking nodes
- WE: Number of waking edges

Normalized Data
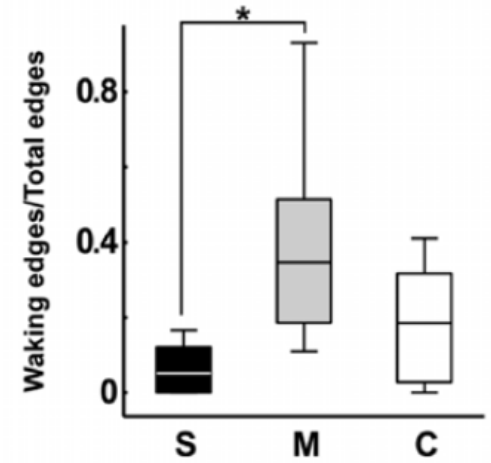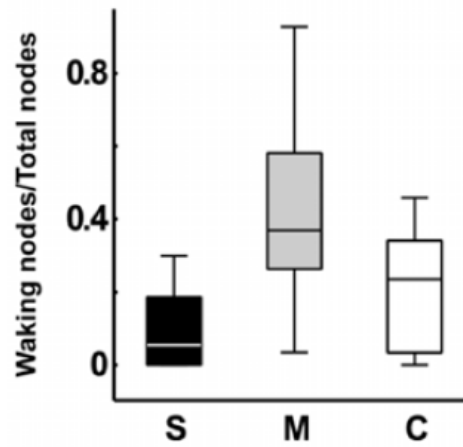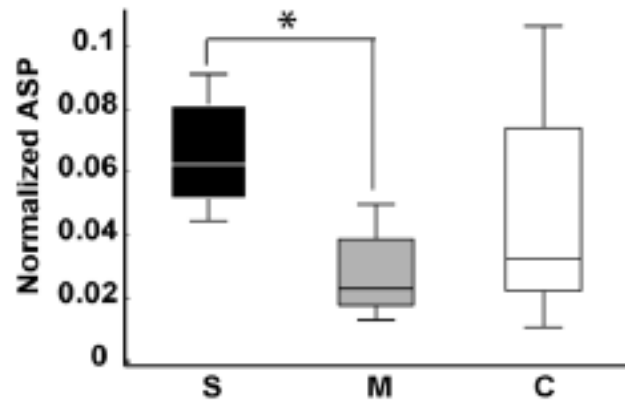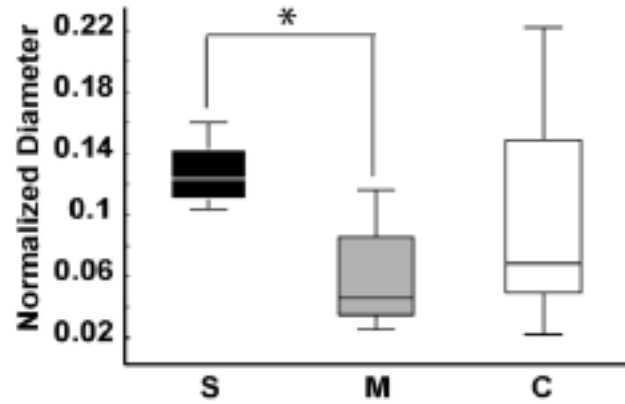
Conclusions from network data

- Manics statistically talk more, have more parallel edges, self-loops, loops, waking edges, and higher average degree than schizophrenics.

- Maniacs are prone to "flights of thought" and "logorrhea".

- Statistical differences are consistent.

What does this mean?

- Future of Psychology/Psychiatry

- Systematization of psychology

- Deep Learning / Artificial Intelligence

- Will computers replace therapists for diagnostic purposes?

IBM **Watson**