WordDiagnostics

Diagnosing Psychiatric Disorders using Artificial Intelligence Based on Word Data

Sverker Sikström
Lund University

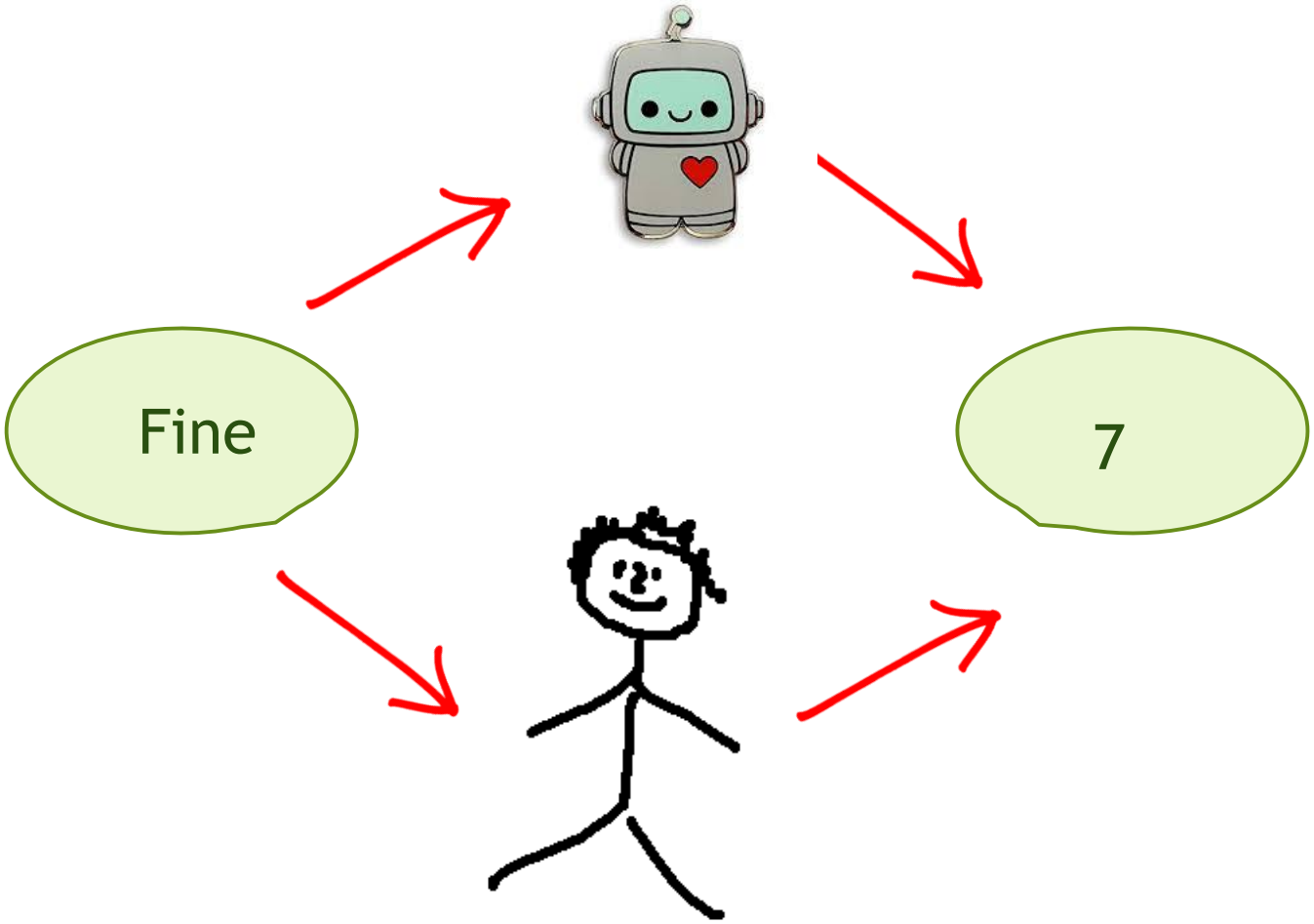
Vitalis, Göteborg, Svenska Mässan, Sal F3, May 22 1430, 2019

How are you?

Fine

7

Who does the measures?



How are concepts measured?

Depression

PATIENT HEALTH QUESTIONNAIRE-9

Over the last 2 weeks, how often have you been bothered by any of the following problems?	Not at all	Several days	More than half the days	Nearly every day
1. Little interest or pleasure in doing things	0	1	2	3
2. Feeling down, depressed, or hopeless	0	1	2	3
3. Trouble falling or staying asleep, or sleeping too much	0	1	2	3
4. Feeling tired or having little energy	0	1	2	3
5. Poor appetite or overeating	0	1	2	3
6. Feeling bad about yourself — or that you are a failure or have let yourself or your family down	0	1	2	3
7. Trouble concentrating on things, such as reading the newspaper or watching television	0	1	2	3
8. Moving or speaking so slowly that other people could have noticed? Or the opposite — being so fidgety or restless that you have been moving around a lot more than usual	0	1	2	3
9. Thoughts that you would be better off dead or of hurting yourself in some way	0	1	2	3

FOR OFFICE CODING

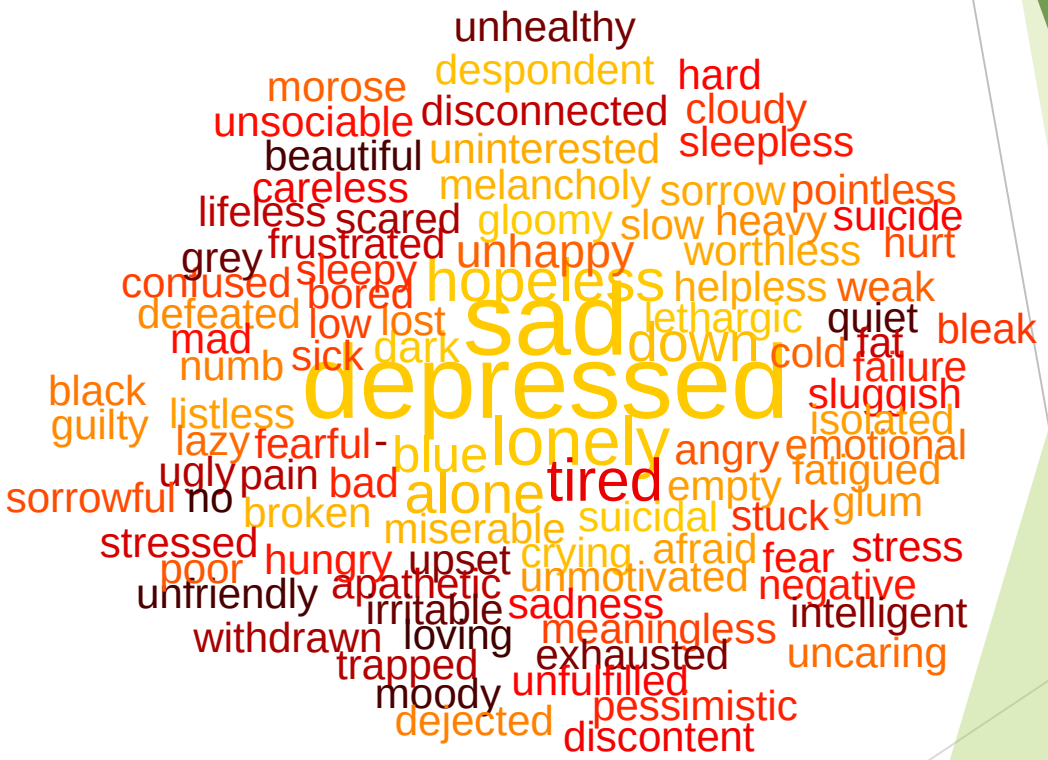
0 + _____ + _____ + _____

=Total Score: _____

If you checked off any problems, how difficult have these problems made it for you to do your work, take care of things at home, or get along with other people?

Not difficult at all	Somewhat difficult	Very difficult	Extremely difficult
☐	☐	☐	☐

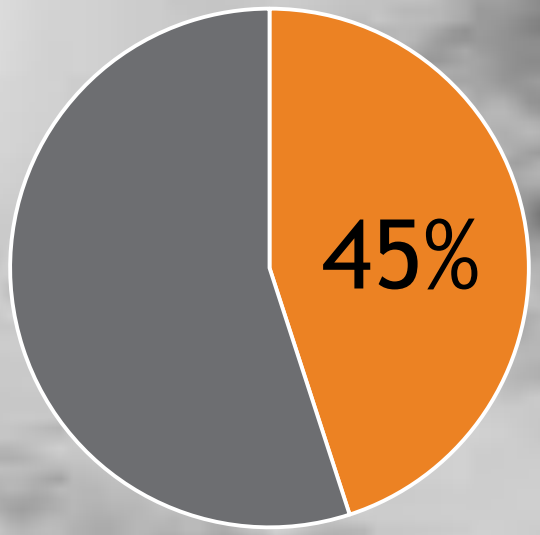
Copyright © 2010 Pfizer, Inc. All rights reserved.



Mental Health – a public health problem

Suffering

Economic costs



45% of sick leave is caused by mental illness.

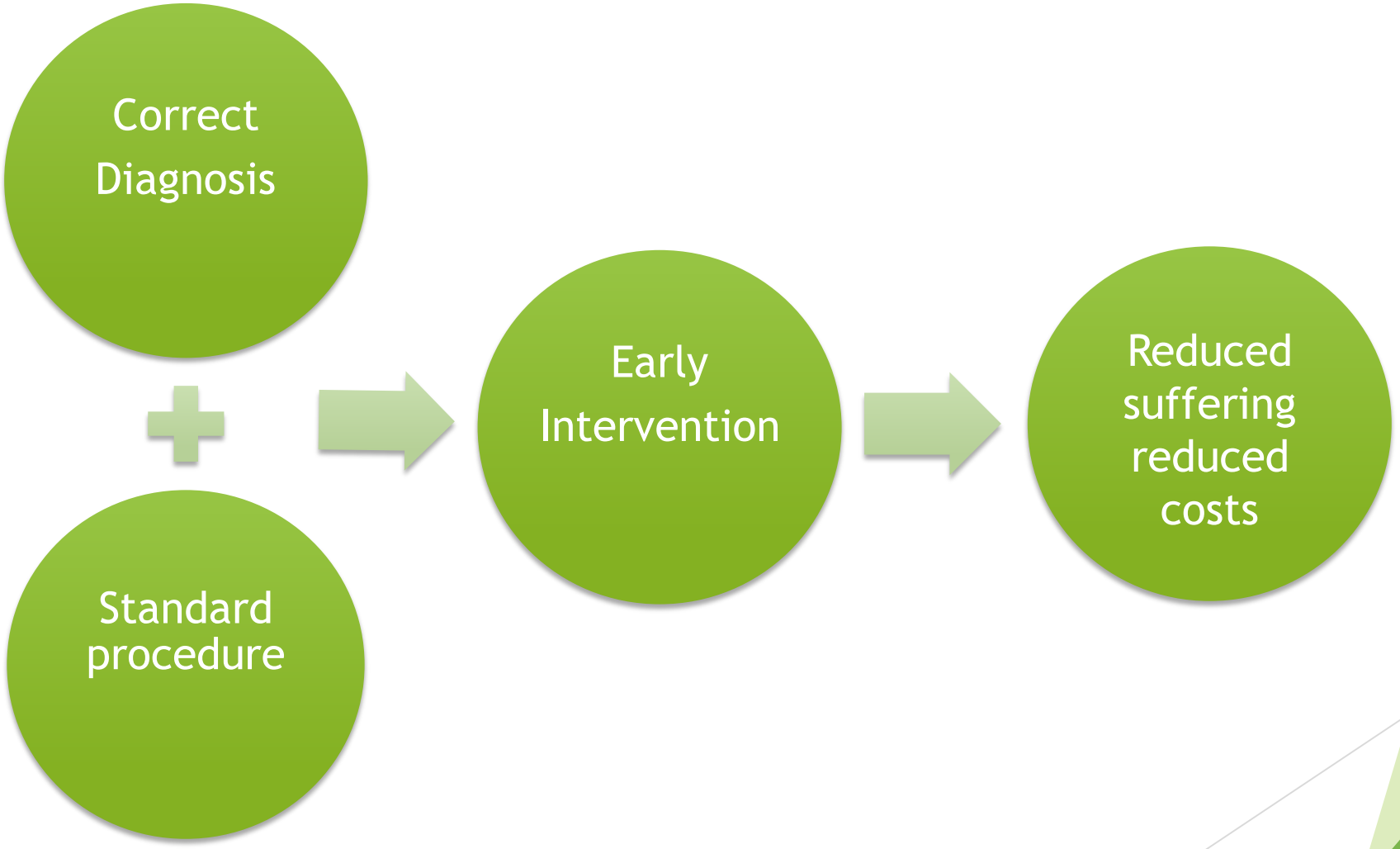
Mental illness gives increased demands on health care

Need:
Faster and more accurate diagnosis

Current Practice:
Rating Scales and interviews

Complementary Solution:
Decision support based on words analyzed with AI

Decision Support Streamlines healthcare



Our Solution: A response format with descriptive words

1. Describe If you are depressed or not:

Low Emptiness Lonely seperated tired

Write any word you want!

2. Words Analyzed with Artificial Intelligence:

Natural Language Processing

-Allows the participant to respond with words describing their own condition

Machine Learning

-Learns the relationship between descriptive words and diagnosis

Why use semantic measures?

1. ***Predict***

   Estimation scales for depression and anxiety

2. ***Describe***

   Provides a personal description,

   rating scales provide only the level of difficulty

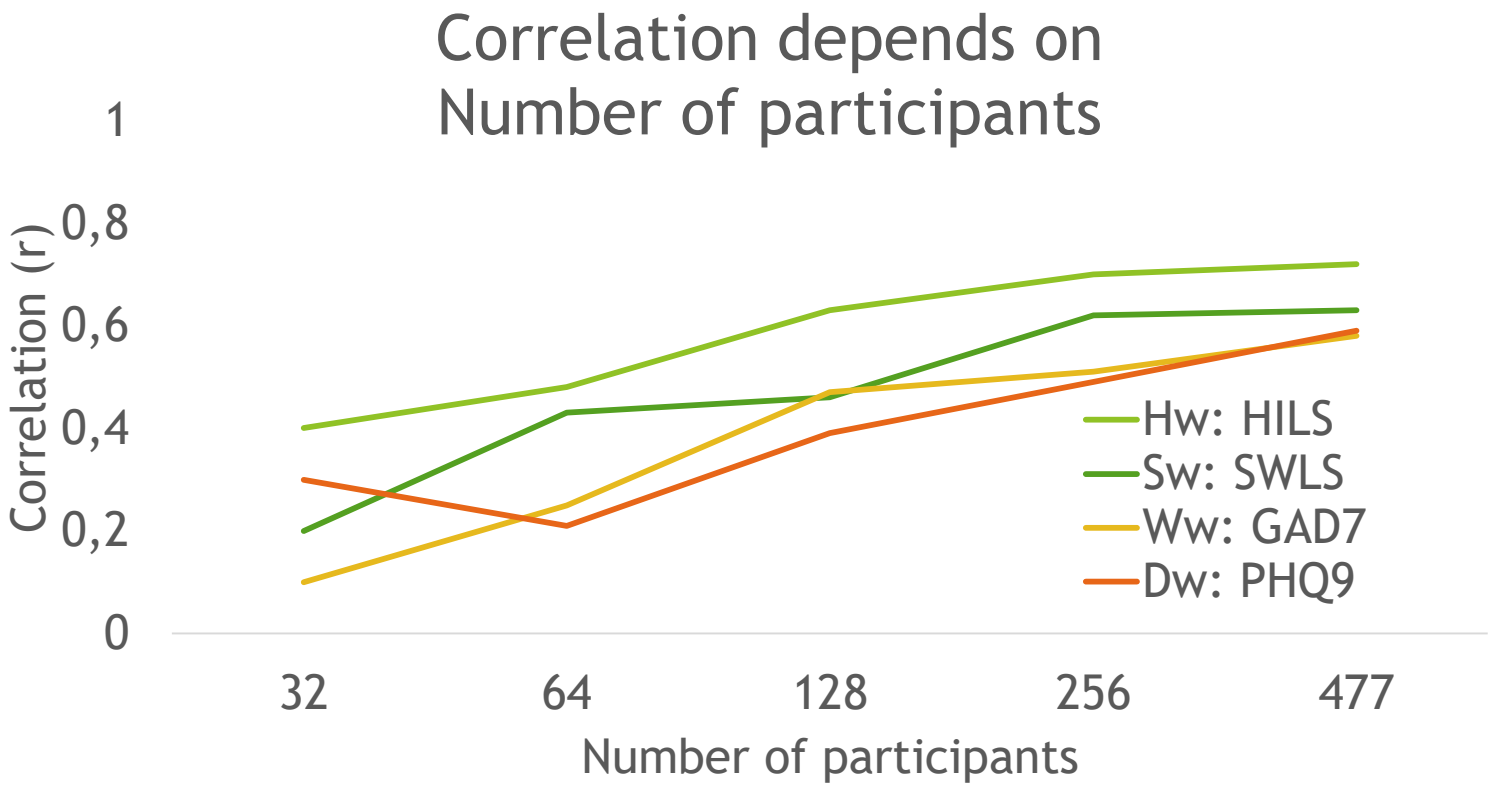
3. ***Differentiate***

   Between depression and anxiety better than rating scales

Kjell, Kjell, Garcia & Sikström, 2018, Psychological Methods

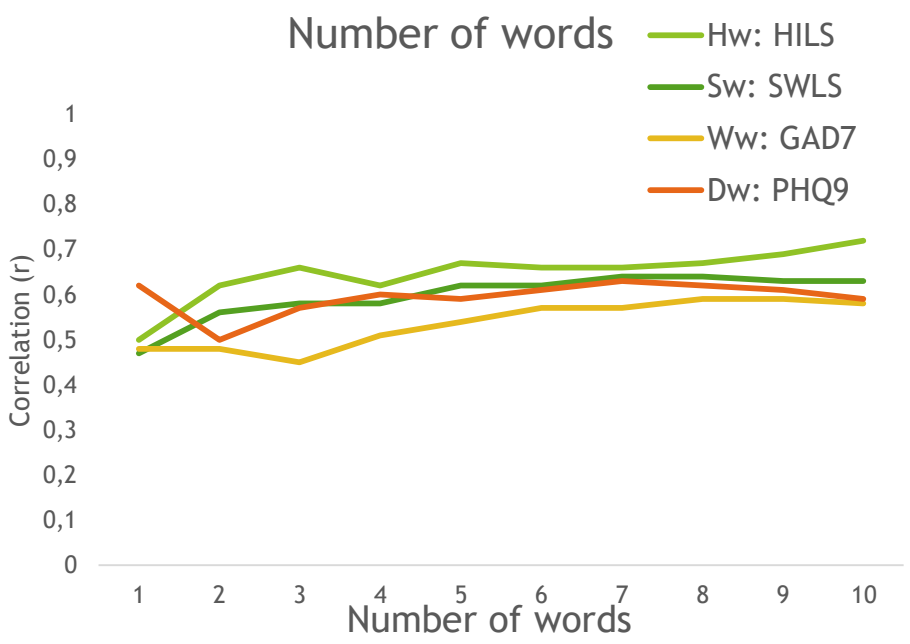
1. Predict:

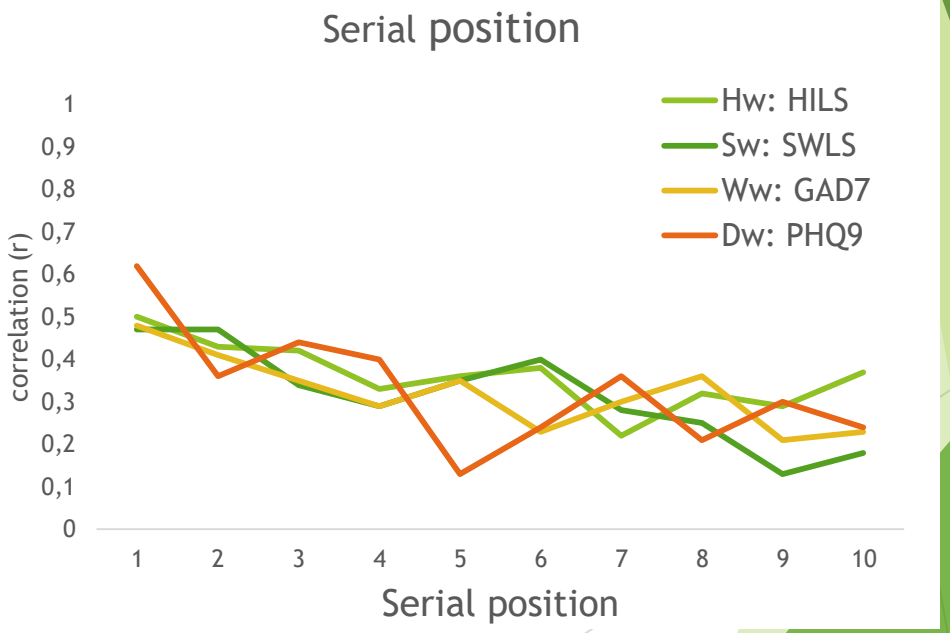
Correlations semantic measures and rating scales r= .58 to .72



1. Predict
Few words are needed

The first word capture the most (≈ r=.5; *p*<.001)



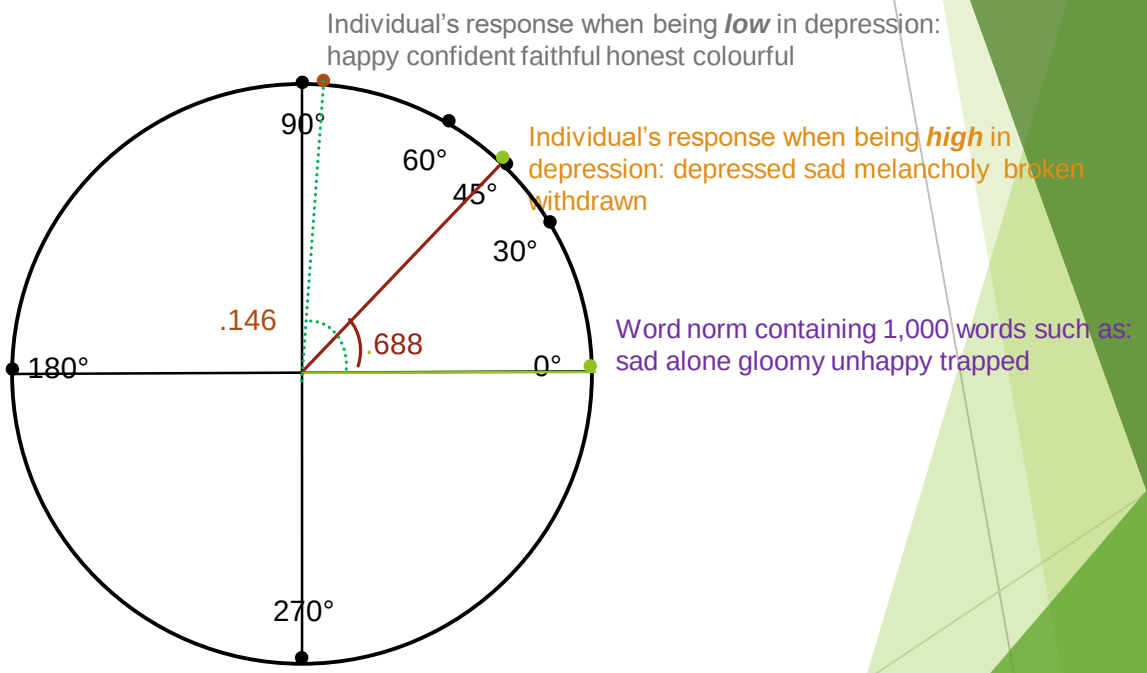


2. Describe:
Word norms for satisfaction and harmony

List words describing the high or low end of the construct

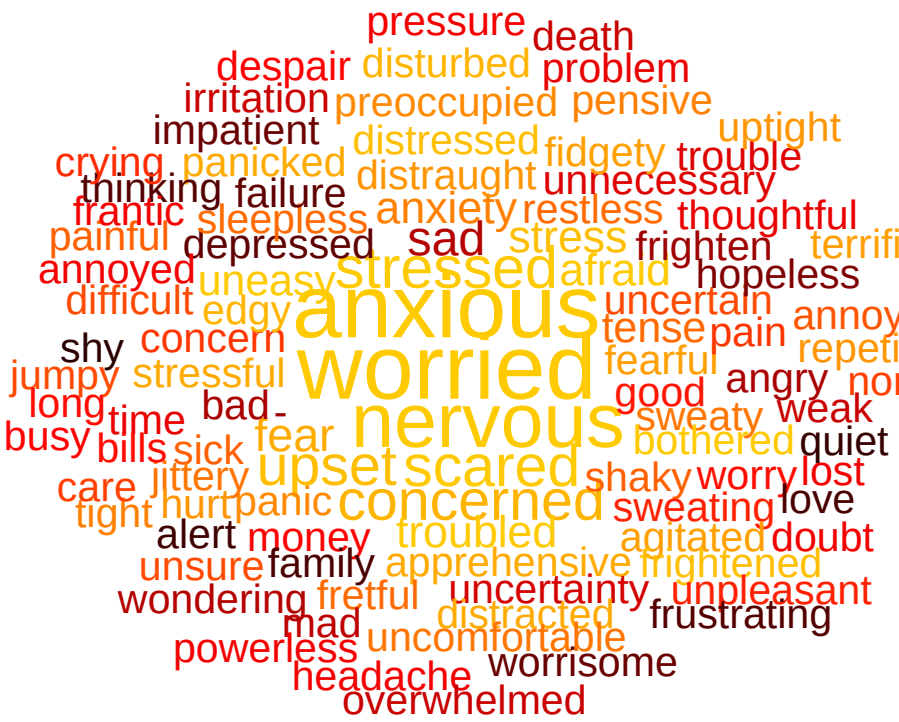
e.g. "Please write 10 words that best describe your view of being /not at all/ in harmony"

Unipolar and Bipolar word norms



2. Describe

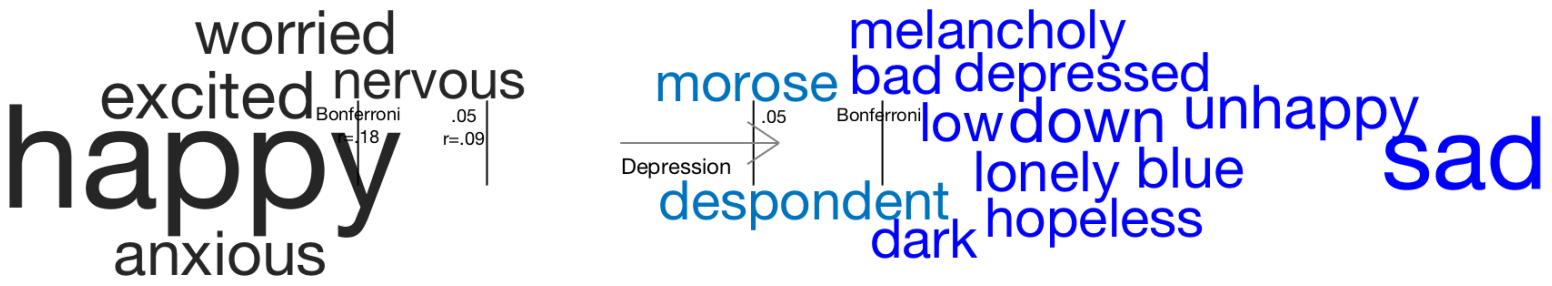
Worry



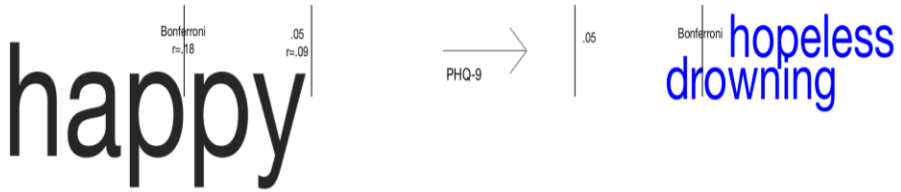
Depression

3. Differentiate: Words describe and differentiate better than rating scales

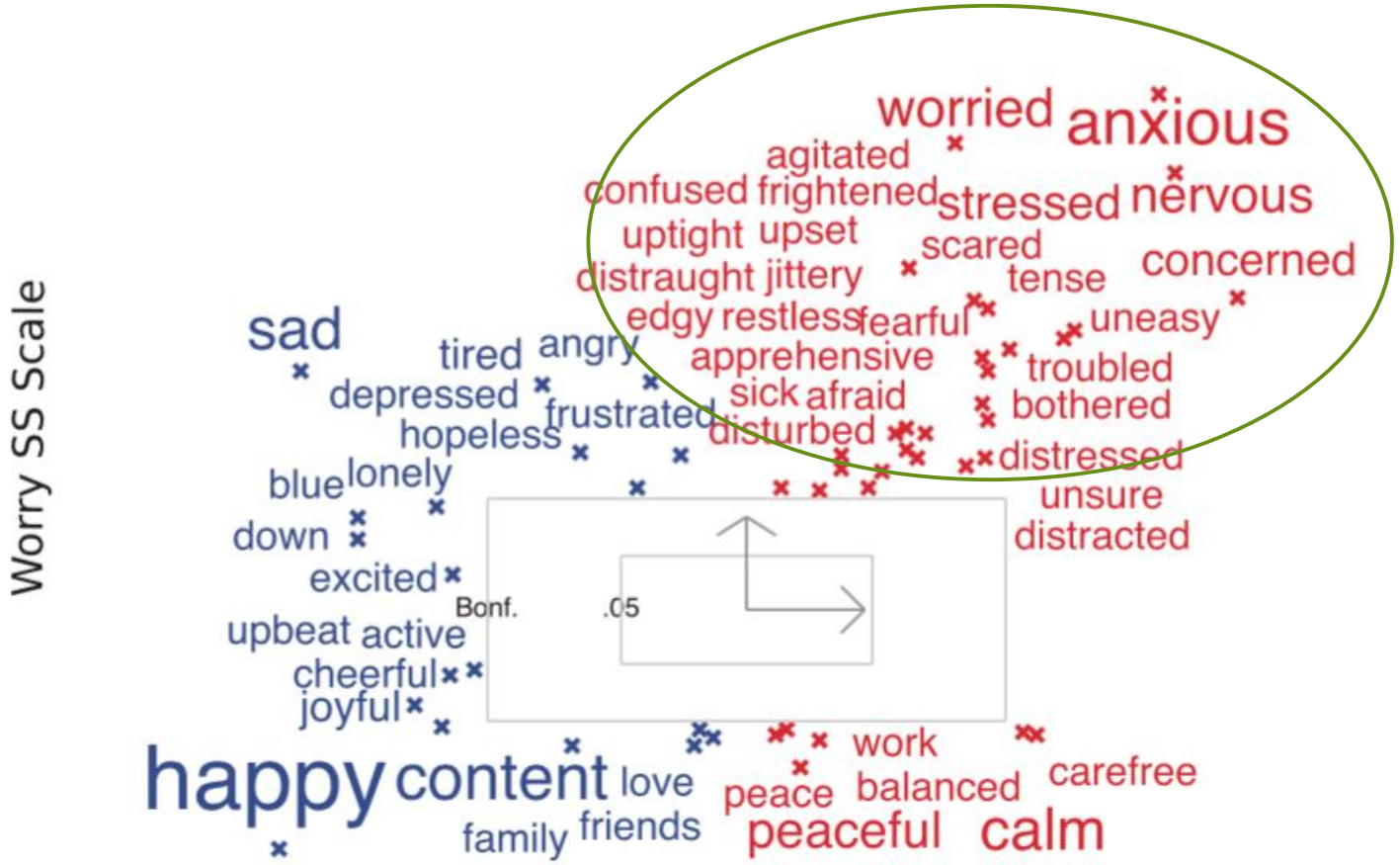
Words analysed with AI:



Rating Scales:

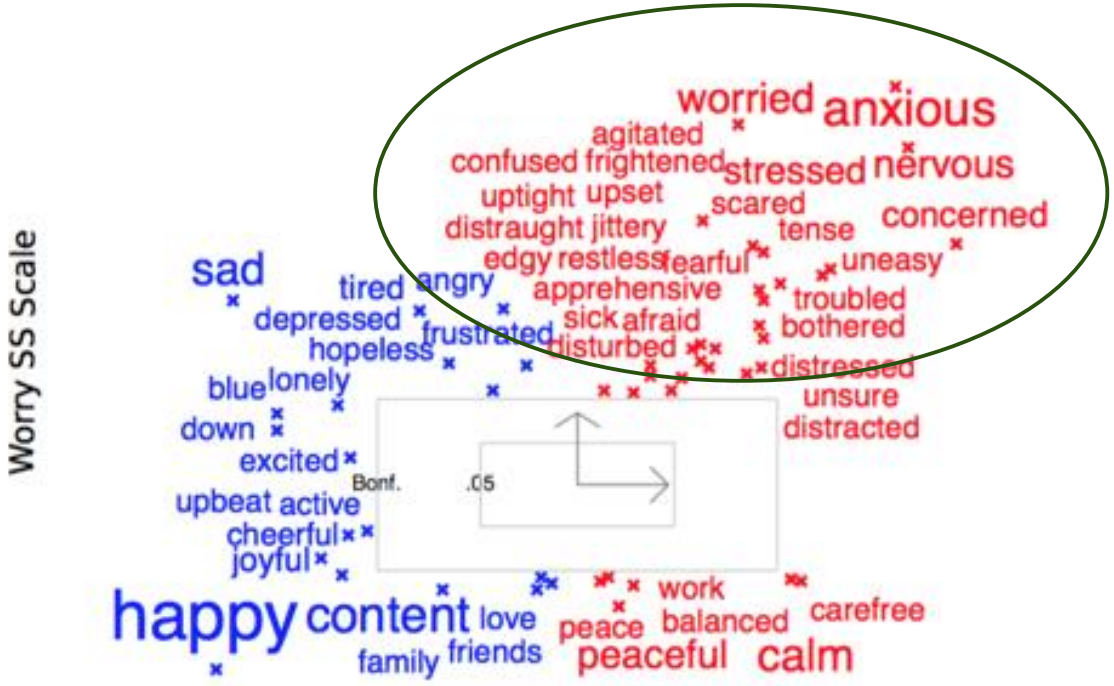


Worry: Semantic Scale



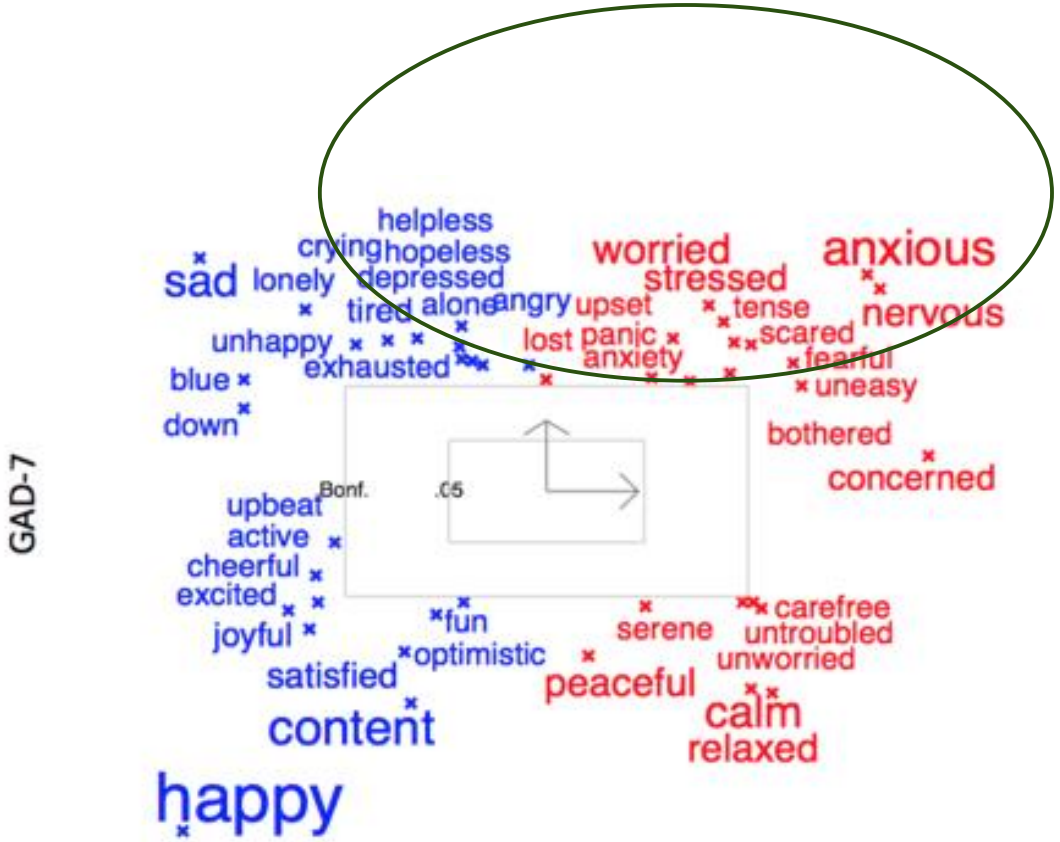
Worry

Semantic Scale



Depression words vs. Worry words

Rating Scale



Depression words vs. Worry words

Validity of semantic measures: Classification of objective stimuli

Semantic question

Describe the facial expression with three descriptive words

Answer: Happy, Smiling, happy

Rating Scale

Estimate the facial expression on the scales:

Happy Sorry Contempt

Response:

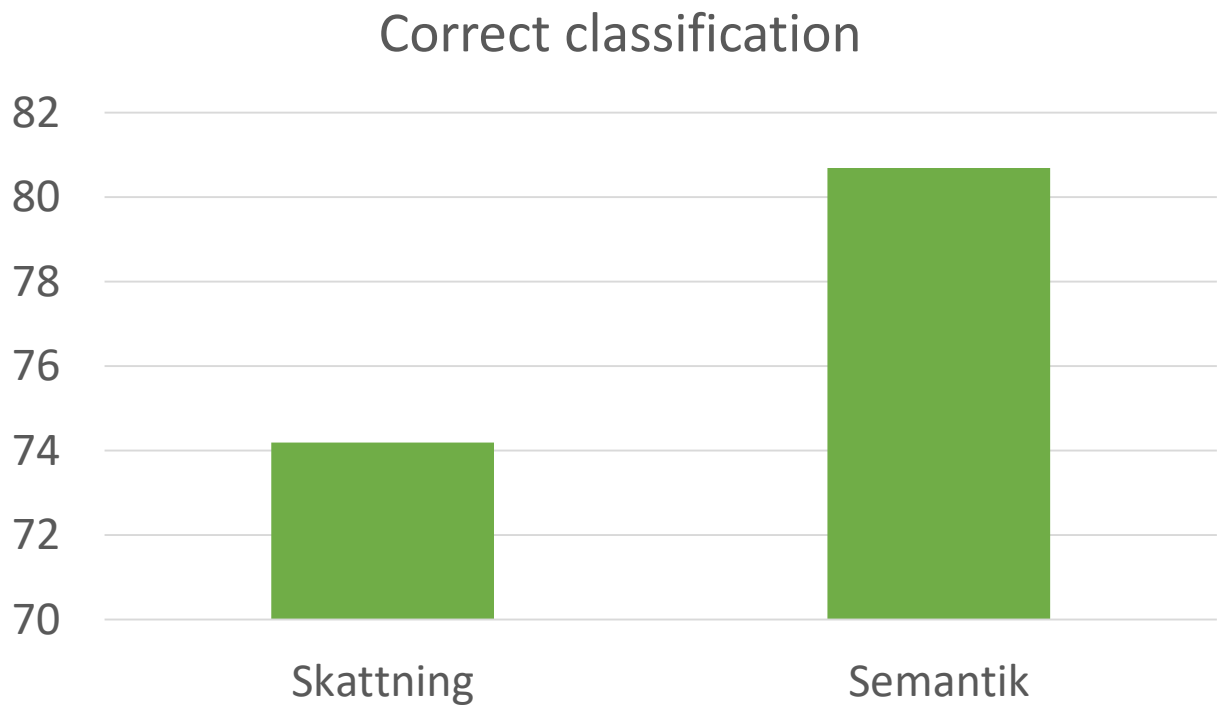
Happy Not at all = 1-------2-------3-------4-------5 = Very much

Sorry Not at all = 1-------2-------3-------4-------5 = Very much

Contempt Not at all = 1-------2-------3-------4-------5 = Very much

Validity: Objective measures

Semantics classifies emotional expressions in faces more accurately than rating scales



How does it work?

Decision support in a clinical setting

Who:

Answered by the patient

When:

Early in the diagnosing process

How:

Respond with Online Survey

What:

Patient Report

WordDiagnostics in daily work

Patients:

Answers the mental healthy survey (20 minutes)

Health Personal:

Get the patient report

Patient

Semantisk fråga Depression

***Under de senaste 2 veckorna, har du varit deprimerad eller inte?**

Svara genom att skriva i 5 ord som beskriver om och hur du känner dig deprimerad. Om du till exempel har varit mycket deprimerad så skriver du fler och starkare ord som beskriver den deppigheten. Om du inte känt dig deprimerad, försök hitta 5 ord som beskriver den upplevelsen istället.

Använd ord som är meningsfulla och viktiga för dig.

Skriv bara ett ord i varje box

Vänligen kontrollera formatet på ditt svar.

Ord 1	ledsen
Ord 2	ensam
Ord 3	tom
Ord 4	sorgsen
Ord 5	svag

Patient

PHQ-9; Patient Health Questionnaire

***Under de senaste 2 veckorna, hur ofta har du besvärats av något/några av följande problem?**

	Inte alls	Flera dagar	Mer än hälften av dagarna	Nästan varje dag
Lite intresse eller glädje av att göra saker	○	○	●	○
Känt dig nedstämd, deprimerad eller upplevt känsla av hopplöshet	○	○	●	○
Svårigheter att somna eller få en sammanhängande sömn, eller sovit för mycket	○	●	○	○
Känt dig trött eller haft för lite energi	○	○	●	○
Dålig aptit eller ätit för mycket	○	●	○	○
Tycker illa om dig själv – eller att du känt dig misslyckad eller att du svikit dig själv eller din familj	○	○	●	○
Svårigheter att koncentrera dig på saker, till exempel att läsa tidningen eller att titta på TV	○	○	○	●
Att du rört dig eller talat så långsamt att andra människor märkt det? Eller motsatsen – att du varit så nervös eller rastlös att du rört dig mer än vanligt	○	○	●	○
Tankar att det skulle vara bättre om du var död eller att du skulle skada dig på något sätt	○	○	●	○

The patient report covers

- Personal data
- Areas
  - Depression: Semantic measure, PHQ 9
  - Concern: Semantic dimensions, GAD-7
  - Stress: Semantic measures, PSS-10
- Function Status and Generally mood
- Wellbeing
- Misuse problems (AUDIT, DUDIT)

Patientrapport

Depressionsproblematik

Depression	16, Moderate, Tired, uninterested, sick, down, off	Figure
PHQ-9	15, Moderate	Expand Figure

Orosproblematik

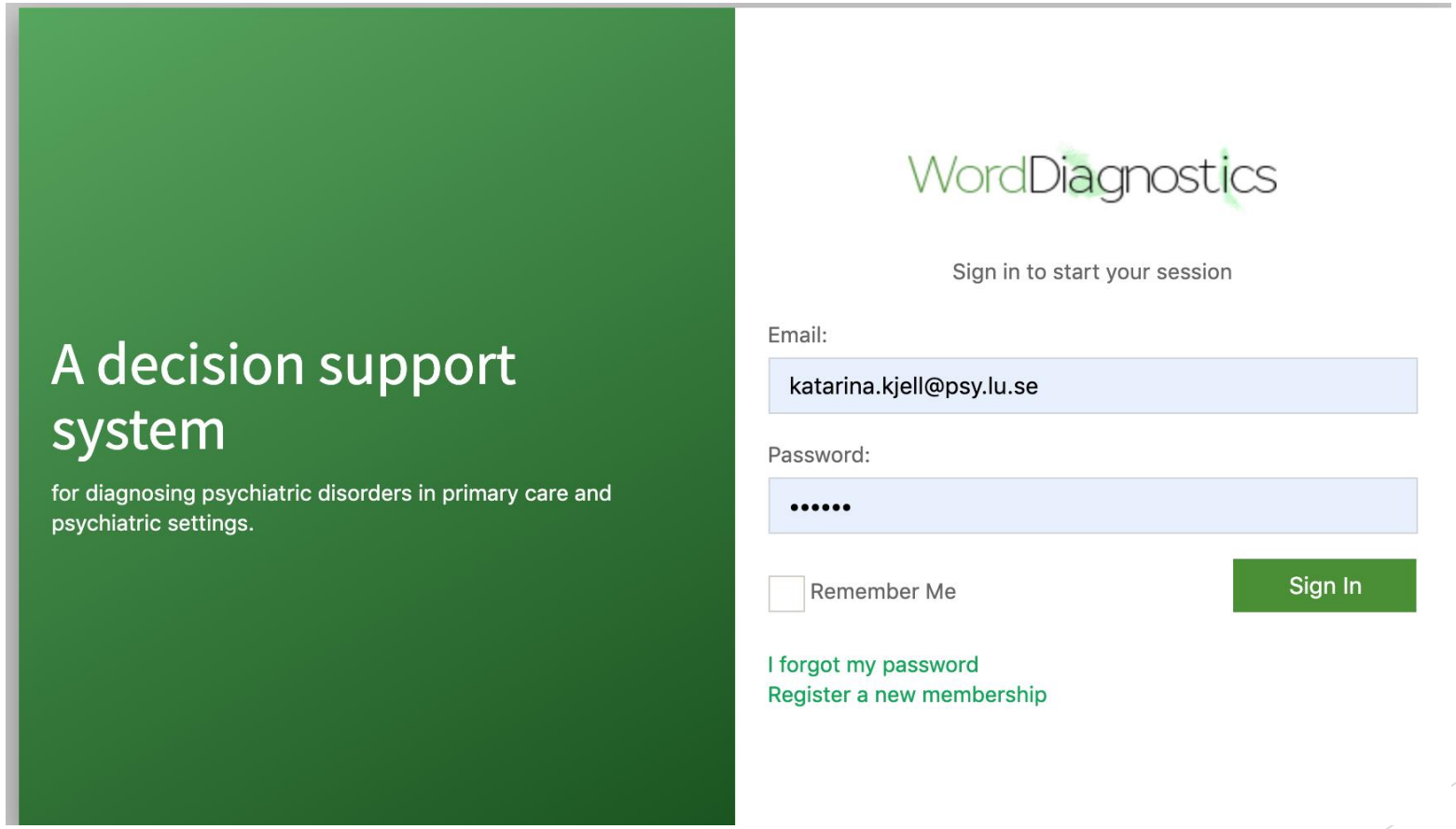
Oro	17, Severe, future, carrier, economic, choices, rambling	Figure
GAD-7	18, Severe	Expand Figure

Stressproblematik

Stress	24, Moderate, demands, yes, requirements, time, split	Figure
PSS-10	24, Moderate	Expand Figure

WordDiagnostic.com

Welcome to try out WD for free within a Vinnova sponsored project



The Decision support is developed in cooperation with:

LUND UNIVERSITY

Livskvalitet i världsklass

åss
ångestförbundet

Riksförbundet
Balans

Prices and grants

LUND UNIVERSITY

venture cup

Familjen Kamprads stiftelse
The Kamprad Family Foundation for Entrepreneurship, Research & Charity

Swedish Research Council

VINNOVA

FORTE
Forskningsrådet för hälsa, arbetsliv och välfärd

Research Group

Sverker Sikström

Professor in cognitive psychology, Lunds universitet.

Artificiell Intelligens

Katarina Kjell

Leg. psykolog, Doktorand i Psykologi, Lunds universitet.

Anxiety and depression.

Oscar Kjell

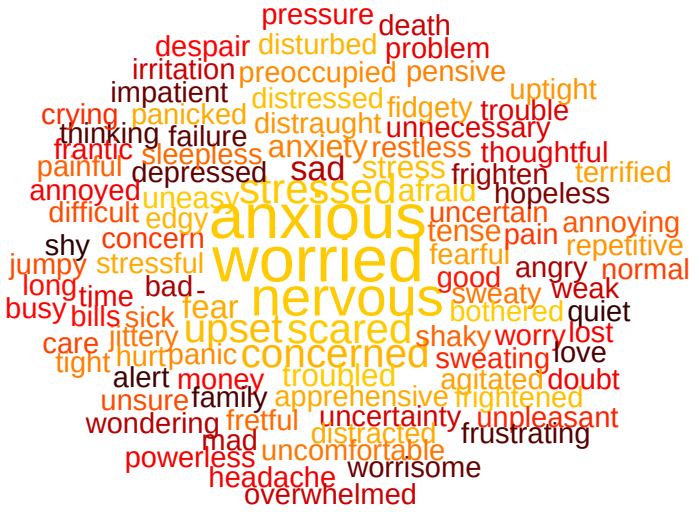
PhD i Psykologi, Lunds universitet.

Psychometry

Questions?

More information: **WordDiagnostic.com**

Or contact: **sverker.sikstrom@psy.lu.se**



WordDiagnostics meets increased demands in healthcare by offering:

En helhetslösning
Combines clinically relevant information with state-of-the-art methods.
Accuracy
The AI interprets and weighs large amounts of data to predict diagnoses.
Adaptability
The AI adapts and learns of new data so it is refined and constantly improved.
Efficiency
The Patient carries out the questionnaire before They meet with their processor — The processor has access to the material for the first meeting.

Standardization
ALL patients receive the same high-quality care.
People Centred Care
Semantic measures Open response puts the patient's experience into focus.
Flexibility
The Patient can conduct the online questionnaire, at home, on the bus or in waiting room.