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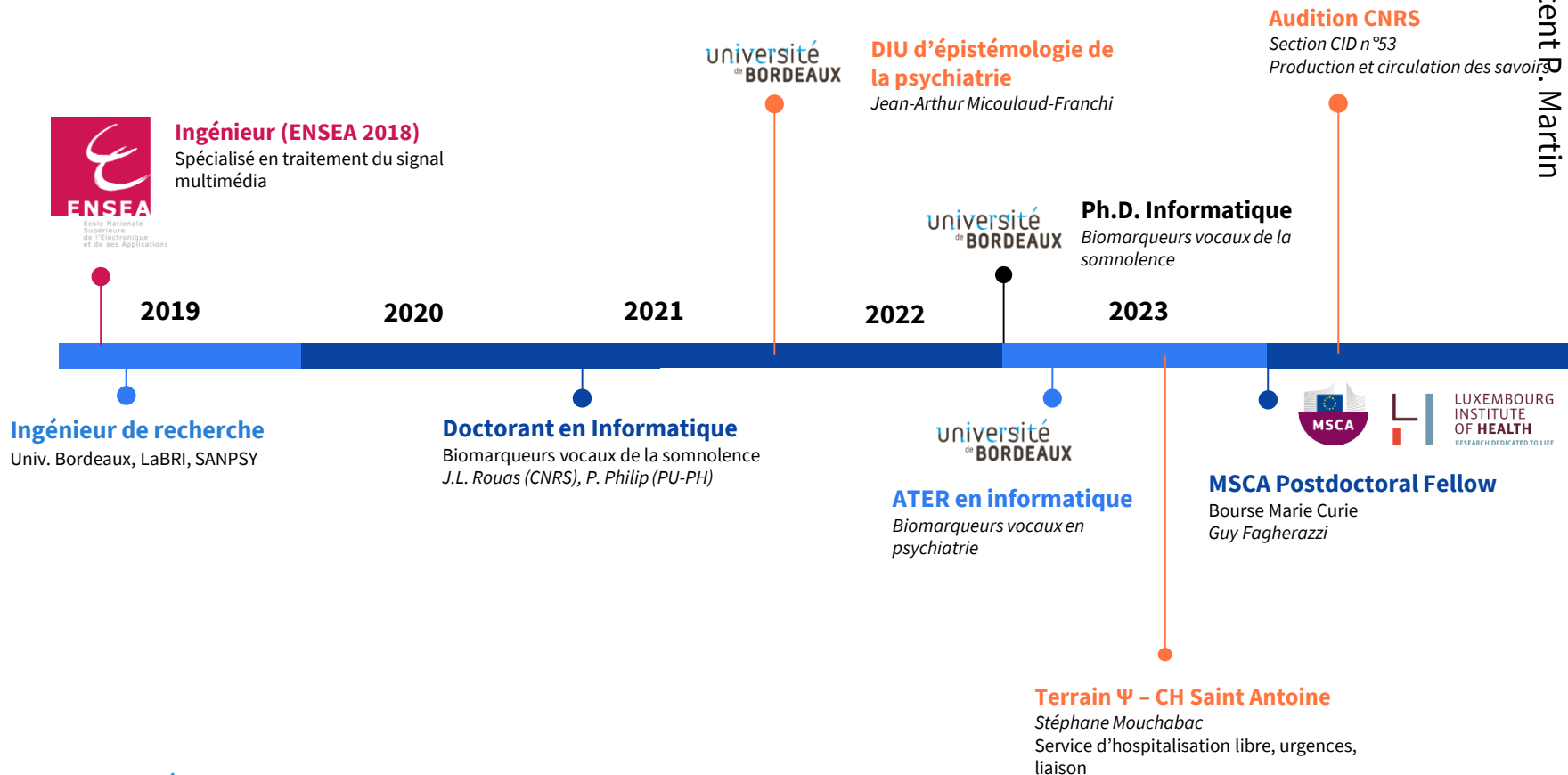
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# Back to the big wide world

How to integrate voice biomarkers into clinical practice in psychiatry?

Vincent P. MARTIN

# Vincent P. Martin



## Conception des biomarqueurs vocaux

- Quels biomarqueurs ?
- Des **biomarqueurs de quoi** ?
- Rôle de l'**explicabilité**
- Perception des **enjeux cliniques**

### Patient utilisateur

- Comment la **rencontre** avec un ACA **transforme l'utilisateur** ?
- Qu'est-ce que son utilisation dit de l'utilisateur ?
- Quel modèle **d'acceptabilité** ?

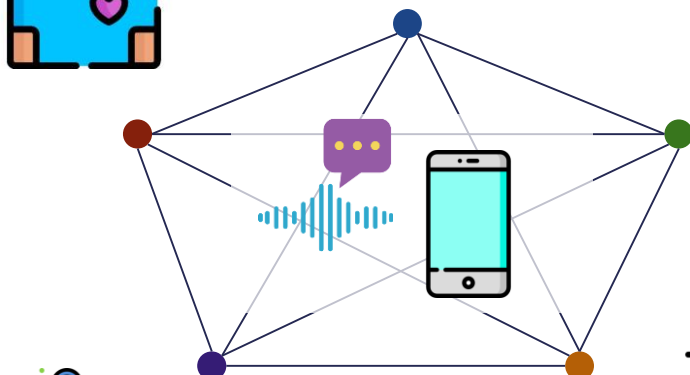


### Terrain médical

- Quelle utilisation du **numérique** dans la pratique médicale ?
- Quels sont les différents acteurs et quel est l'impact sur chacun d'entre eux ?
- Quel accueil de ces **promesses de changements** ?

### Rôle social du patient/clinicien

- Comment le passage à une « **santé** numérique » change le **rôle social du clinicien et du patient** ?
- **Performance** de santé



### Raisonnement clinique

- Comment raisonnent les cliniciens ?
- Quelle est la place du **diagnostic** dans leurs décisions ?
- Quels **symptômes** minimaux ?

- « Les psychiatres » → intéressés par numérique
- Terrain → soins libres, urgences généralistes
- $\Phi$  de la  $\Psi$ : phénoménologie, approches critiques des neurosciences/diagnostic
- Frontière philo de terrain / socio floue

**1/8** of the pop.

Mental disorder

**-20** year

Life expectancy

**1/3** depression

Without structured mental health care

# Needs: Follow-up



Accessible



Regular



Ecological



Fatigue

Depression

Sleepiness

...



Smartphones



80% of the  
world pop.



REGULAR

ECOLOGICAL

OBJECTIVE

*“Gold-standard diagnostic and assessment tools for depression and suicidality remain rooted, almost exclusively, on the **opinion of individual clinicians** risking a range of **subjective biases**. Currently there is no **objective measure**, with **clinical utility**, for either depression or suicidality”*



# Need for objective diagnosis

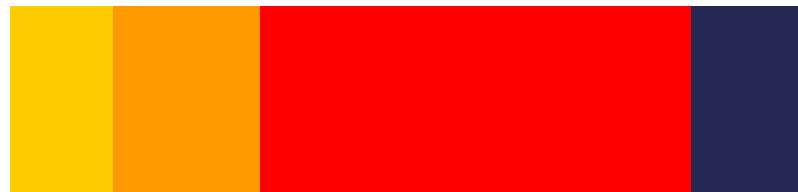
28<sub>m</sub> health professionals

14,9% definitions of the diseases

21,6% patients' characteristics

63,5% clinicians' characteristics

87% diagnosis = not reliable



# Need for objective diagnosis

**Table 6.—Diagnoses Given to Patient F**

	American Psychiatrists (N = 133)	British Psychiatrists (N = 194)
<b>Schizophrenia</b>	92 (69%)	4 (2%)
Simple	0	1
Catatonic	1	0
Paranoid	27	1
Latent	8	0
Residual	3	0
Schizo-affective	33	1
Unspecified	20	1
<b>Personality Disorder</b>	10 (8%)	146 (75%)
Paranoid	1	2
Affective (cyclothymic)	1	8
Explosive	0	2
Hysterical	4	105
Asthenic	0	2
Antisocial	1	8
Unspecified	3	19
<b>Affective Psychosis</b>	10 (8%)	7 (4%)
<b>Neurosis</b>	19 (14%)	37 (19%)
<b>Alcoholism or Drug Dependence</b>	2	0

Clinicians need objective assessments  
of psychiatric disorders

# 125 studies

68 depression

23 schizophrenia

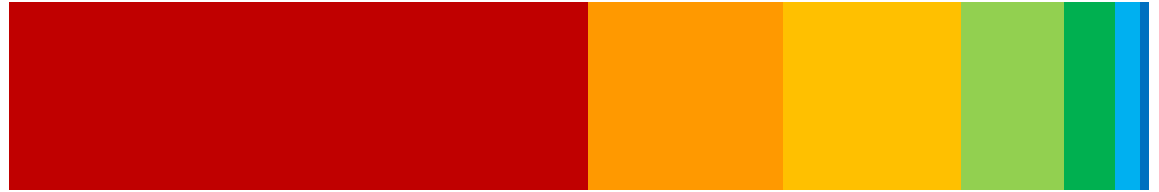
21 bipolar disorder

12 PTSD

6 anxiety

3 eating disorders

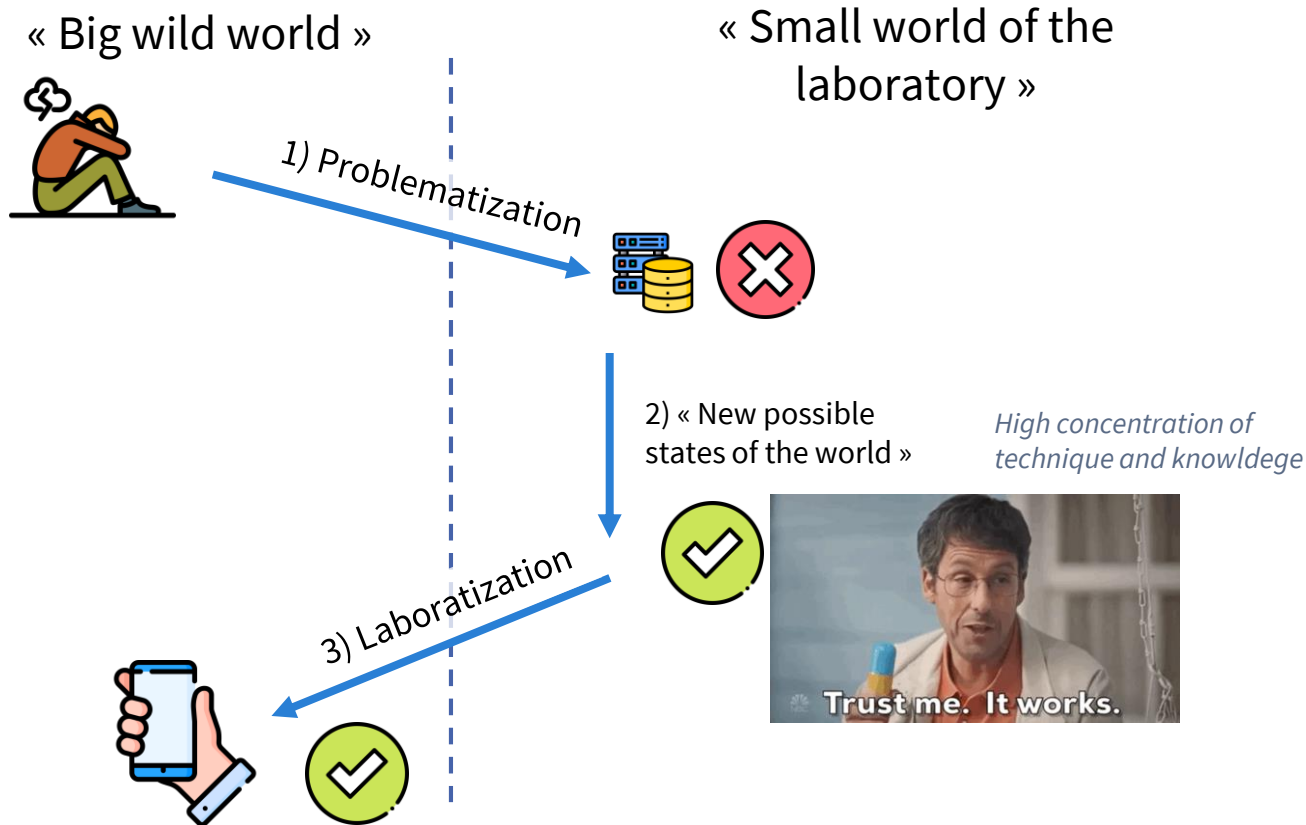
1 OCD



# Where are they?



# Sociology of traduction



# Les moutons de Sellafield

Incendie de Windscale 1957

Sellafield, BBC, 31 Octobre 1983

Tchernobyl, 21 avril 1986



« Les chercheurs croient qu'un mouton est un mouton ; les éleveurs savent bien qu'une telle tautologie est une grossière erreur [...] C'est parce que les spécialistes ne le voit pas qu'ils butent sur un obstacle qu'ils ne peuvent surmonter»

Clinicians need objective assessments  
of ~~psychiatric disorders~~



# Why estimating the diagnosis is a bad idea

1

Clinical practice

2

Heterogeneity

3

Unstability

18

***'You may have depression'***

***'You have a 80% probability of having  
schizophrenia'***

***'You are bipolar'***

# Why estimating the diagnosis is a bad idea

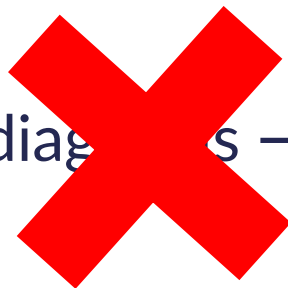


Clinical practice



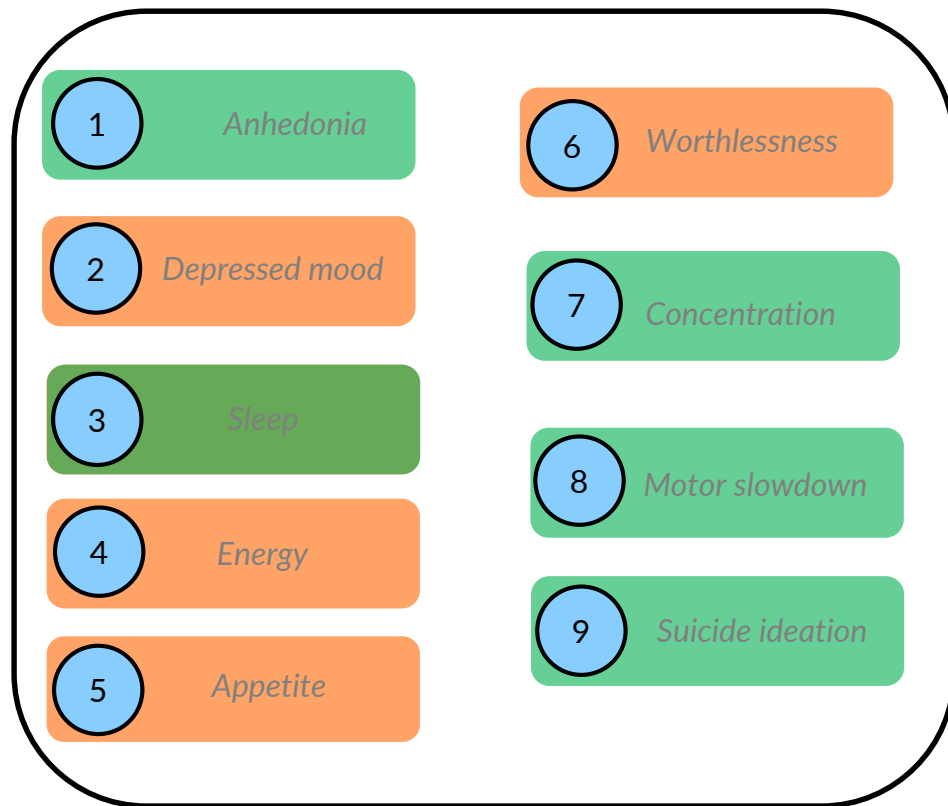
Heterogeneity

Symptoms → diagnosis → treatments



Diagnostic announcement = critical

# Heterogeneity



- Depression =
- At least 5
  - $n^{\circ}1$  or  $n^{\circ}2$

326 profiles



**Eiko Fried:**

[STAR\\*D \(2015\)](#) :

1030 profiles / 3703 “depressive” patients (DSM-5)

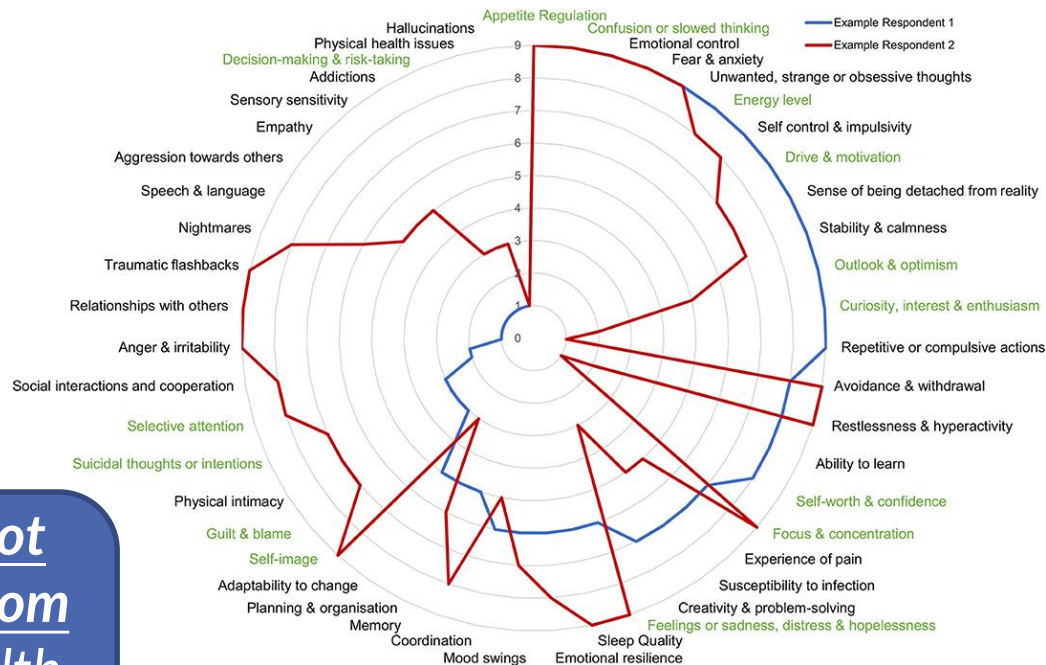
# Heterogeneity

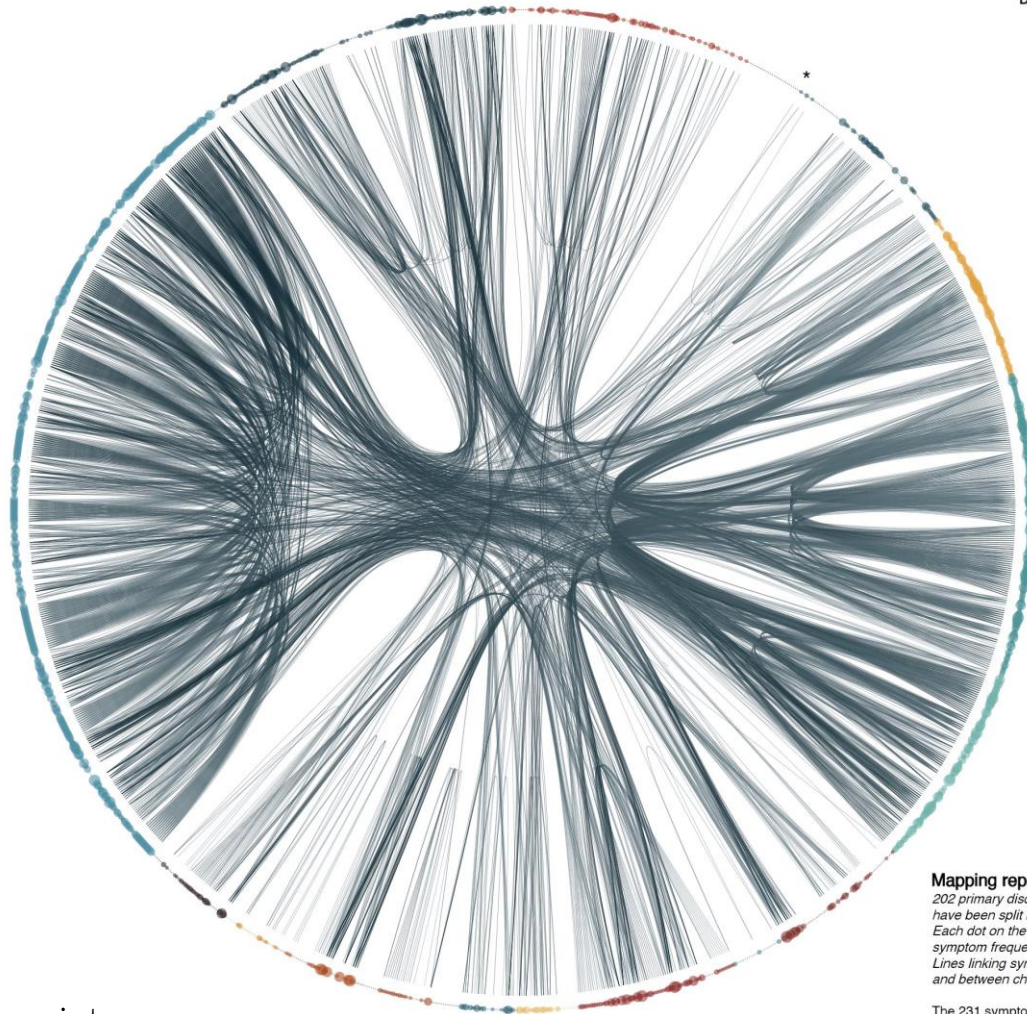
107349 patients

10 most prevalent disorders

47 symptoms

*« DSM-5 disorder criteria do not separate individuals from random when the complete mental health symptom profile of an individual is considered »*





#### DSM-5 Chapter (clockwise from \*)

- Ch1 – Neurodevelopmental Disorders
- Ch2 – Schizophrenia Spectrum and Other Psychotic Disorders
- Ch3 – Bipolar and Related Disorders
- Ch4 – Depressive Disorders
- Ch5 – Anxiety Disorders
- Ch6 – Obsessive-Compulsive and Related Disorders
- Ch7 – Trauma- and Stressor-Related Disorders
- Ch8 – Dissociative Disorders
- Ch9 – Somatic Symptom and Related Disorders
- Ch10 – Feeding and Eating Disorders
- Ch11 – Elimination Disorders
- Ch12 – Sleep-Wake Disorders
- Ch13 – Sexual Dysfunctions
- Ch14 – Gender Dysphoria
- Ch15 – Disruptive, Impulse-Control, and Conduct Disorders
- Ch16 – Substance-Related and Addictive Disorders
- Ch17 – Neurocognitive Disorders
- Ch18 – Personality Disorders
- Ch19 – Paraphilic Disorders

#### Mapping repetition among all symptoms in the DSM-5

202 primary disorders and specifiers are represented; diagnostic criteria have been split into 1419 constituent symptoms.

Each dot on the circumference is a symptom; the size represents symptom frequency.

Lines linking symptoms map the repetition between diagnoses, within and between chapters.

The 231 symptoms that repeat at least once (mean [SD] repetition = 4.4 [3.41]) comprise 72.0% of the psychopathology described in the DSM-5.

# Why estimating the diagnosis is a bad idea



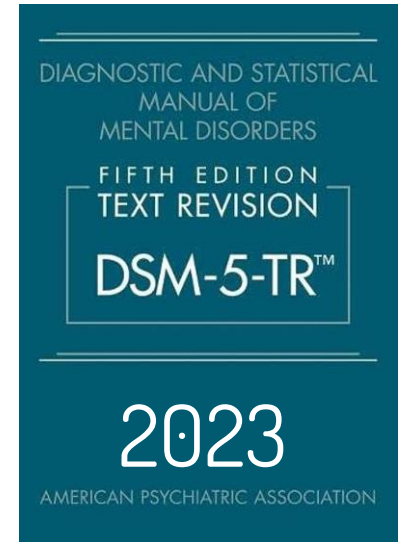
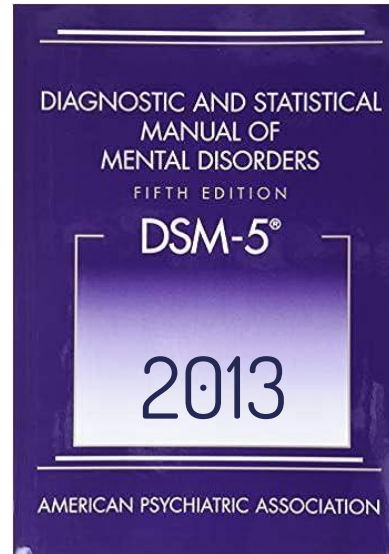
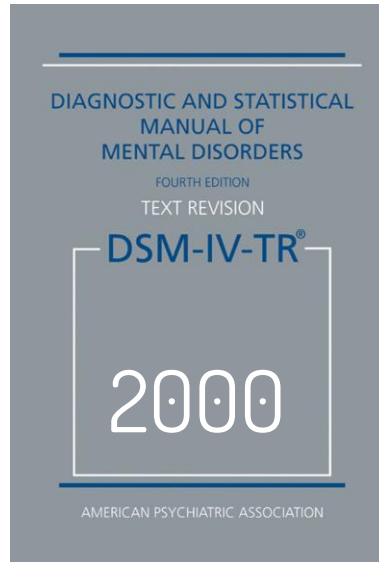
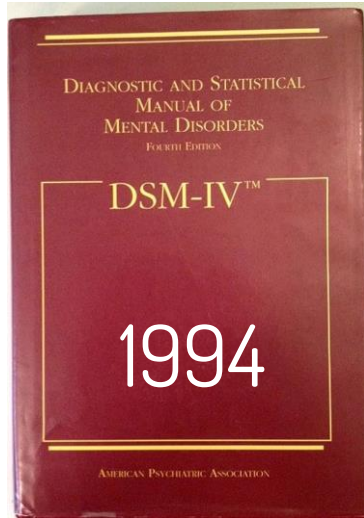
Clinical practice



Heterogeneity



Unstability



# Why estimating the diagnosis is a bad idea



Clinical practice



Heterogeneity



Unstability

## Glossary of Cultural Concepts of Distress

### Ataque de nervios

*Ataque de nervios* (“attack of nerves”) is a syndrome among individuals of Latino descent, characterized by symptoms of intense emotional upset, including acute anxiety, anger, or grief; screaming and shouting uncontrollably; attacks of crying; trembling; heat in the chest rising into the head; and becoming verbally and physically aggressive. Dissociative experiences (e.g., depersonalization, derealization, amnesia), seizure-like or fainting episodes, and suicidal gestures are prominent in some *ataques* but absent in others. A general feature of an *ataque de nervios* is a sense of being out of control. Attacks frequently occur as a direct result of a stressful event relating to the family, such as news of the death of a close relative, conflicts with a spouse or children, or witnessing an accident involving a family member. For a minority of individuals, no particular social event triggers their *ataques*; instead, their vulnerability to losing control comes from the accumulated experience of suffering.

No one-to-one relationship has been found between *ataque* and any specific psychiatric disorder, although several disorders, including panic disorder, other specified or unspecified dissociative disorder, and conversion disorder, have symptomatic overlap with *ataque*.

In community samples, *ataque* is associated with suicidal ideation, disability, and out-

### Taijin kyofusho

*Taijin kyofusho* (“interpersonal fear disorder” in Japanese) is a cultural syndrome characterized by anxiety about and avoidance of interpersonal situations due to the thought, feeling, or conviction that one’s appearance and actions in social interactions are inadequate or offensive to others. In the United States, the variant involves having an offensive body odor and is termed *olfactory reference syndrome*. Individuals with *taijin kyofusho* tend to focus on the impact of their symptoms and behaviors on others. Variants include major concerns about facial blushing (erythrophobia), having an offensive body odor (olfactory reference syndrome), inappropriate gaze (too much or too little eye contact), stiff or awkward facial expression or bodily movements (e.g., stiffening, trembling), or body deformity.

*Taijin kyofusho* is a broader construct than social anxiety disorder in DSM-5. In addition to performance anxiety, *taijin kyofusho* includes two culture-related forms: a “sensitive type,” with extreme social sensitivity and anxiety about interpersonal interactions, and an “offensive type,” in which the major concern is offending others. As a category, *taijin kyofusho* thus includes syndromes with features of body dysmorphic disorder as well as delusional disorder. Concerns may have a delusional quality, responding poorly to simple reassurance or counterexample.

The distinctive symptoms of *taijin kyofusho* occur in specific cultural contexts and, to some extent, with more severe social anxiety across cultures. Similar syndromes are found in Korea and other societies that place a strong emphasis on the self-conscious maintenance of appropriate social behavior in hierarchical interpersonal relationships. *Taijin kyofusho*-like symptoms have also been described in other cultural contexts, including the United States, Australia, and New Zealand.



# What is the role of diagnostic ?

- Communication

‘one of its most important goal is to **facilitate communication among clinicians, researchers, administrators and patients** [...] by establishing a common language.’ Derek Bolton, 2012

- Recognition by society and specialists

→ loop effect (Ian Hacking)

"Some of these individuals will **alter their behavior** due to the **novel self-experience enabled by this classification**, which functions as a **new representation for self-understanding**."

D. Mourey

# What can we do?

A young girl with dark hair, wearing a white shirt with pink floral patterns and a pink backpack, is looking towards a white robot. The robot has a round head with blue glowing eyes and is holding a bouquet of pink cherry blossoms. The background is a blurred city street at night with many lights.

Clinical interview = **symptoms & signs**

Treatment = **symptoms & signs**

# Estimation of symptoms



Clinical practice

- Treatment
- Diagnosis announcement



Heterogeneity

- Fundamental unit of clinical reasoning



Unstability

- Stable through time and culture



Epistemic injustices



Health



New tasks



Biomarkers



# Estimation of symptoms



Biomarkers



New tasks



Health



Epistemic injustices

## Prognostic

How will the patient evolve in the coming days/weeks/months?

## Differential diagnosis

Distinguishing resembling but different disorders (e.g. unipolar depression vs. bipolar disorder)

## Therapeutic targeting

Precision therapeutic based on symptoms

# Estimation of symptoms



Biomarkers



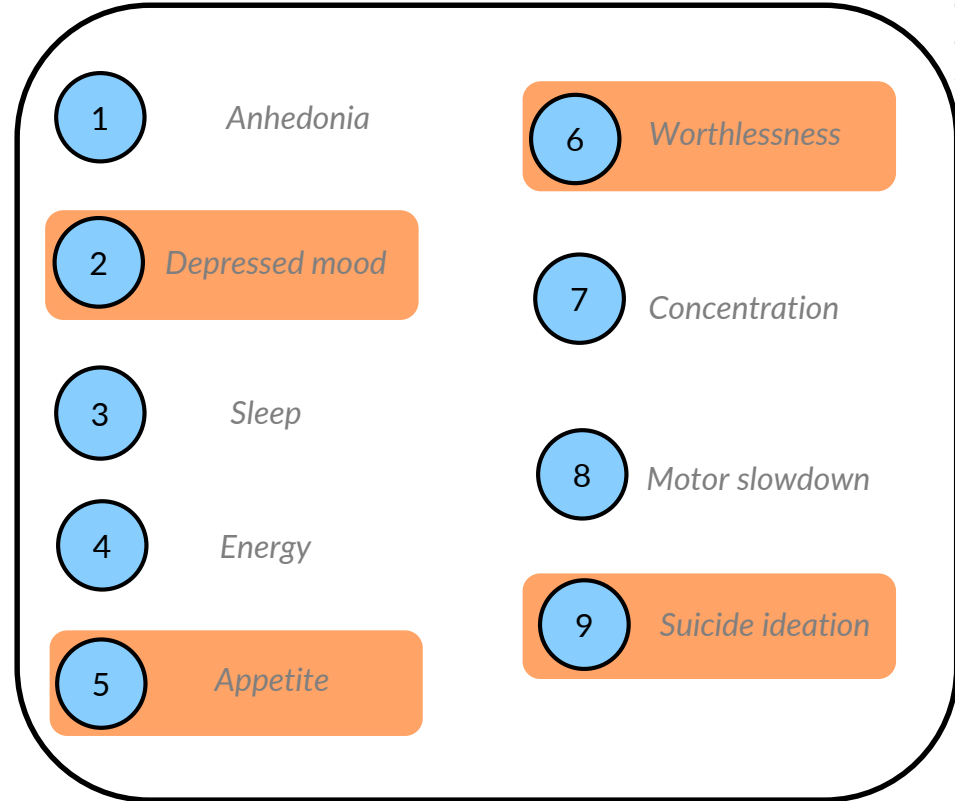
New tasks



Health  $\neq$  Pathology



Epistemic injustices



# Estimation of symptoms



Biomarkers



New tasks



Health



Epistemic injustices

## Testimonial injustices

→ « objective » evidence

## Hermeneutic injustices

→ underrepresented or understudied populations

Clinicians need objective assessments of  
**psychiatric disorders**



Clinicians need objective assessments of  
**symptoms**



Is estimating symptoms instead  
of diagnosis enough?

# Psychiatrists point of view

515 psychiatrists



Data privacy  
and security

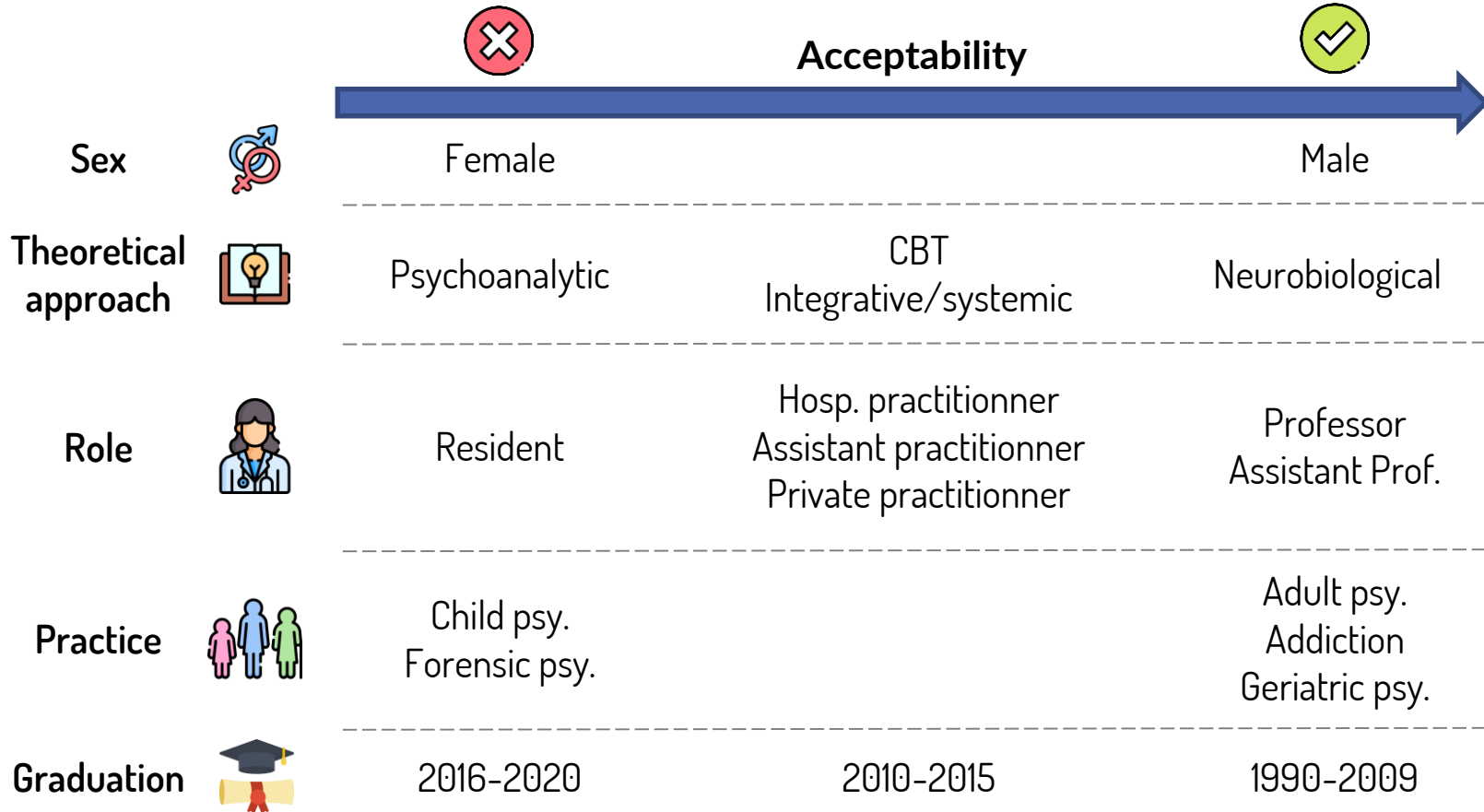
1/3 situation

- Smartphone EMA
- Connected wristband
- MRI Machine learning



Therapeutic  
alliance

# Psychiatrists point of view



Clinicians **need** objective assessments  
of psychiatric disorders



**Some** clinicians may **use complementary**  
objective assessments of symptoms

# Lessons from self-tracking data

1

23 Danish  
General practitioners



[Haase et al. 2023,](#)  
*Social Studies of Science*

2

20 French  
Sleep specialists



[Calvignac 2023,](#)  
*Médecine du Sommeil*

3

12 Belgian  
GP and cardiologists



[Gabriels et al. 2018,](#)  
*JMIR*



# General practitioners



Reliability/accuracy  
transparency

*Interestingly, they did not seem to ever explore whether the wearables actually were 'validated'.*

*[...] data as relational objects that only **make sense** when the **wider clinical context is known***



Recontextualisation  
→ actionability



# General practitioners



Recontextualisation  
→ actionability



Self-reported  
questionnaires



Cardiac data



Sleep data

*Data from online symptom and health checkers had **different evidential value** - even when the test was exactly the same - **depending on who initiated the test and on which platform it was performed***



# General practitioners



Recontextualisation  
→ actionability



Self-reported  
questionnaires



Cardiac data



Sleep data

*Regardless of their thoughts about the validity of the actual test results, the GPs investigated the reasons why the patient had conducted the test.*

*I use them as a springboard for a discussion about 'but why did you take it?'*





# General practitioners



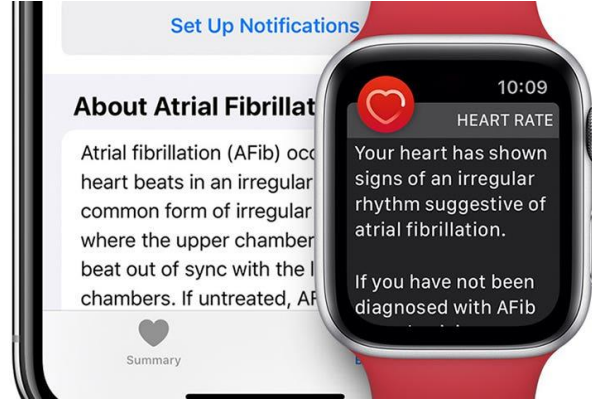
Recontextualisation  
→ actionability



Self-reported  
questionnaires



Cardiac data



*These patients are here because of an incredibly high measurement, but it is unsure whether there is a real problem or just an error.*

[10, cardiologist]



Sleep data



# General practitioners



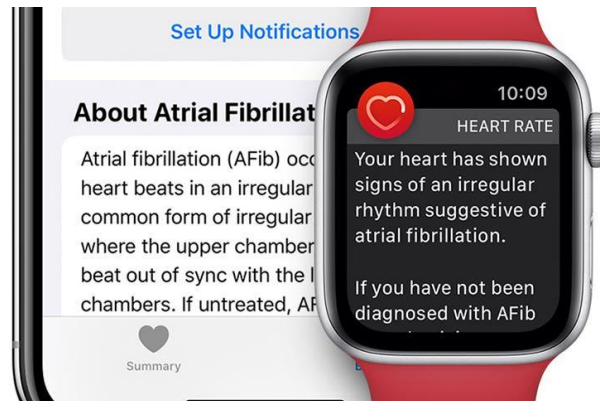
Recontextualisation  
→ actionability



Self-reported  
questionnaires



Cardiac data



Complementary  
exams



Sleep data

Data were seen as *sufficient to initiate clinical action* or, if the data indicated something harmless, the GPs would immediately dismiss any further investigations.



# General practitioners



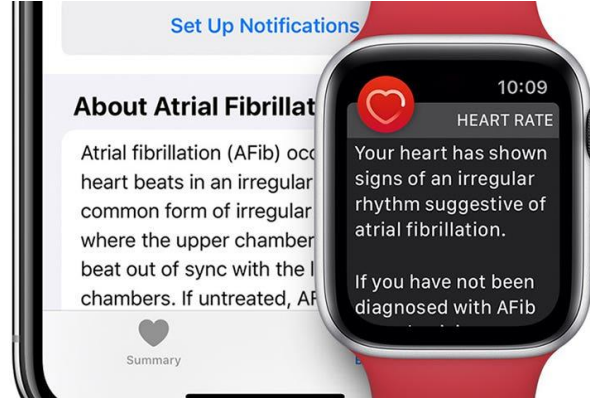
Recontextualisation  
→ actionability



Self-reported  
questionnaires



Cardiac data



Complementary  
exams

Nothing



Sleep data

*“If the **clinical information** did not indicate a heart disease, Johnny suggests he would consider **the data from the wearable insignificant** or unrelated to this claim for this specific patient”*



# General practitioners



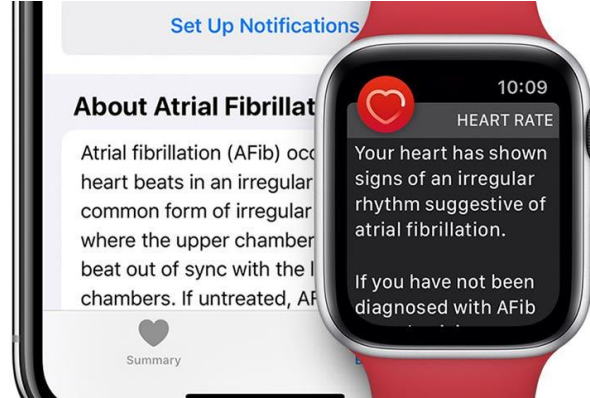
Recontextualisation  
→ actionability



Self-reported  
questionnaires



Cardiac data



Complementary  
exams

Nothing



Sleep data

“The GPs found it challenging to *convince patients* that it could be *‘normal’* (non-pathological) to receive *‘abnormal’* (beyond certain thresholds) *test results.*”



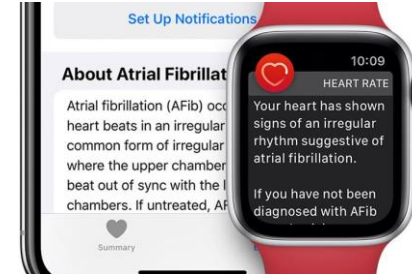
# General practitioners



Recontextualisation  
→ actionability



Self-reported  
questionnaires



Cardiac data

*“At one point, a Saturday evening at 11 pm, I received an e-mail that contained a deviated heart rate measurement. I think ‘hmm, this is strange.’ So I send him [the acquaintance] an e-mail and he lets me know that he was at a reception, where he met someone who said that he suffered from a heart rhythm disorder and he [the acquaintance] subsequently gave him his smartphone to try the technology.”*

[12, cardiologist]



Sleep data

Some clinicians may use complementary  
objective assessments of symptoms



Some clinicians may use complementary  
**and contextualized** objective  
assessments of symptoms



# General practitioners



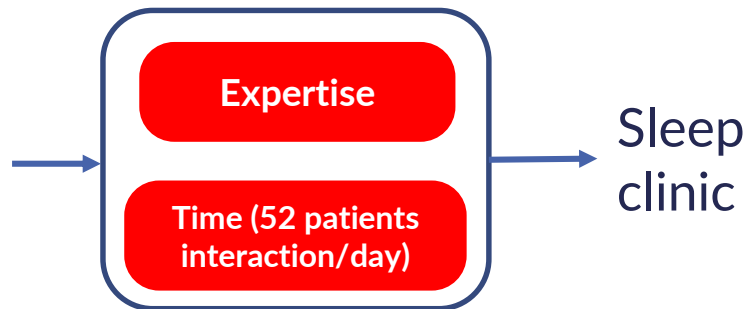
Self-reported  
questionnaires



Cardiac data



Sleep data



*'my phone states that I am not sleeping well enough'*

*"Then I refer some of them [the patients] to a sleep monitoring clinic but they get rejected"*

# Lessons from self-tracking data

1

23 Danish  
General practitioners



[Haase et al. 2023,](#)  
*Social Studies of Science*

2

20 French  
Sleep specialists



[Calvignac 2023,](#)  
*Médecine du Sommeil*

3

12 Belgian  
GP and cardiologists



[Gabriels et al. 2018,](#)  
*JMIR*





# Sleep specialists

Reliability/accuracy  
transparency



## How **Explainability** Contributes to Trust in AI

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Italy

Notions of explainability and evaluation approaches for explainable artificial intelligence

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*School of Computer Science, College of Science and Health, Technological University Dublin, Dublin, Republic of Ireland*



Transparency? Actionability? Faithfulness? Interpretability?  
Informativeness? Explicability? Explicitness?

### Integrating Artificial Intelligence into Medical Education: Lessons Learned From a Belgian Initiative

Ilaria Pizzolla, Rania Aro, Pierre Duez, Bruno De Lièvre, Giovanni Briganti, University of Mons, Belgium

Journal of Interactive Learning Research Volume 34, Number 2, 2023 ISSN 1093-023X Publisher: Association for the Advancement of Computing in Education (AACE), Waynesville, NC

Journal Info Table of Contents New Issue alerts



# Sleep specialists

Reliability/accuracy  
transparency



## How Explainability Contributes to Trust in AI

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Politecnico di Milano  
Italy

## On the Relation of Trust and Explainability: Why to Engineer for **Trustworthiness**

Lena Kästner\*, Markus Langer †, Veronika Lazar†, Astrid Schomäcker\*, Timo Speith\*‡, Sarah Sterz\*‡

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Explainability **contributes** to trust  
Explainability is **not necessary** for trust



### Integrating Artificial Intelligence into Medical Education: Lessons Learned From a Belgian Initiative

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Journal Info Table of Contents New Issue alerts



# Sleep specialists

1

## Variety of offers on the market

Reliability/accuracy  
transparency



Most of them provide **inaccurate data** compared to what can be recorded, and often **worry patients** who come in saying, 'I don't have deep sleep' or 'I only have sleep like this or like that,' when **a watch absolutely cannot, at least currently, detect sleep stages** and thus gives a very biased view to patients."

*Interview 5, neurologist, public sector, 14 years of experience, Auvergne-Rhône-Alpes.*

'Datadvertasing' approaches  
= insincere advertising because too flattering.

Patients behavior



179 applications      2 publications



53% proofs

73 applications

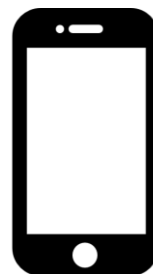
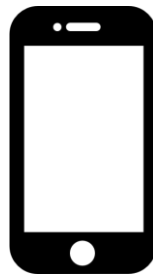


49 claims

27% not clear



20% no proof



**Fondation FondaMental**

9 035 abonnés

Maintenant

[Replay 🗣️]

👤 La première conférence de la rentrée de la Fondation FondaMental accueillait Pierre-Yves Mousset, président de la start-up **Gynov** et CEO de **NovoBiome**

💡 Face à l'augmentation des besoins en psychiatrie depuis la crise sanitaire, il rappelle la nécessité d'appréhender le soin de manière globale, en tenant compte non seulement des troubles psychiatriques mais aussi des pathologies somatiques.

🧠 Cette approche holistique, basée sur la médecine de précision, permettra la création de start-ups françaises en santé mentale intéressantes pour des fonds d'investissement. Ainsi, NovoBiome s'intéresse aux liens entre notre système digestif et notre cerveau.

➡ Cette conférence est disponible en replay :

<https://lnkd.in/exhcWf2d>

**#santementale #mentalhealth #psychiatrie**

👉 Ensemble, soutenons l'innovation en psychiatrie. Faites un don à la Fondation FondaMental.



# Sleep specialists



Reliability/accuracy  
transparency

- 1 Variety of offers on the market
- 2 Validation pop.



Patients behavior



# Sleep specialists

Reliability/accuracy  
transparency



- 1 Variety of offers on the market
- 2 Validation pop.
- 3 Score transparency and stability over time

'You have a sleep score of 80%.' **What does this sleep score of 80% mean?** 80% of what?"

(Interview 6, neurologist, public sector, 30 years of experience, Provence-Alpes-Côte d'Azur)





# Sleep specialists



Reliability/accuracy  
transparency

"All the professionals interviewed, without exception, initially asserted that, most of the time, **these self-measurements revealed less about sleep itself than about the sleeper.** In other words, it's not so much the data themselves as the act of self-collection that carries meaning."



Patients behavior

## Adherence

"The patient who comes in with an app they've been using for three months, where they've noted many things, **it's an important aspect of the patient's personality,** and it becomes a lever for follow-up."

(Interview 8, pulmonologist, private sector, 30 years of experience, Île-de-France)

Some clinicians may use complementary and contextualized objective assessments of symptoms



Some clinicians may use complementary, **transparent, validated** and contextualized objective assessments of symptoms

# Lessons from self-tracking data

1

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General practitioners



[Haase et al. 2023,](#)  
*Social Studies of Science*

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[Gabriels et al. 2018,](#)  
*JMIR*



# GP & Cardiologists



Patient autonomy

“There is the *danger that patients will play doctor themselves*. They will themselves decide whether or not to increase their blood pressure medication or diuretic pill. »  
GP



Patient behavior  
changes

Doctor 12 (a cardiologist), however, believes *this is not a major problem, as long as patients act within certain limits*. For example, patients with *diabetes* already adjust their medication based on their daily self-tracking of blood sugar levels, which is described as a *positive evolution*.



# GP & Cardiologists



Patient autonomy

*I have the feeling that they do measure their parameters and that they are subsequently **more aware of the problem**, but [that] this **does not really lead to behavioral changes**.*

*[4, GP]*



Patient behavior  
changes

# Health performance and health obsession

"Now we all want to be on the same model. People ask you in consultation: 'How many hours should I sleep?' 'What time should I go to bed?' They love rules. [...] That's the perverse effect of this type of application, this type of connected object, is that you're given objectives that don't necessarily correspond to your physiology"

(Interview 8, pulmonologist, private sector, 30 years' experience, Île-de-France).

[Calvignac 2023](#), Médecine du Sommeil



## Orthosomnia

"Clearly, when the Excel spreadsheet is beautifully crafted, when the graphs are meticulously detailed, we can clearly see the patient's obsessive nature [...]"

(Interview 1, neurologist, public sector, 12 years of experience, Occitanie)

[Calvignac 2023](#), Médecine du Sommeil

## Worried well cohort

*Yes, I expect that health disparities might increase because those who will use it [self-tracking tools] are **the ones that are already part of the privileged class.***

[2, GP]

## Entertainment medicine

*“On the one hand I know it [digital self-tracking] will be very useful for certain groups that we currently do not sufficiently reach. [...] But with these apps you perform a whole lot of **‘entertainment’ medicine.**”*

[7, GP]

# Tech billionaire who spends \$2 million a year to look young is now swapping blood with his 17-year-old son and 70-year-old father

BY ORIANNA ROSA ROYLE

May 23, 2023 at 12:42 PM GMT+2



"Young blood" infusions are part of Johnson's \$2 million a year anti-aging routine.

KYLE GRILLOT—BLOOMBERG/GETTY IMAGES

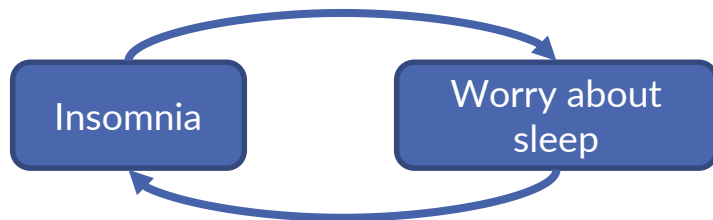


## Stop using these tools

"But then, when people really use them, self-measurement technologies are more of *a factor in fixing symptoms in the wrong sense of the word*, rather than a help. [...] on the contrary, we're going to teach them ... well, we're going to *ask them to detach themselves from these tools.*"

(Interview 13, psychiatrist, private practice, 40 years' experience, Paris region)

[Calvignac 2023](#), Médecine du Sommeil



## Tool of self-investigation

They [the patients] come and say, 'my phone states that I am not sleeping well enough', then I ask 'well, are you tired?' [the patients answer] 'no I am not' [then I ask] 'do you have a problem then?' [laughing]

[Haase et al. 2023](#), SSS

[...] *People need to get to know themselves. It's also our job [...] to explain to them how to get to know themselves.*"

(Interview 8, pulmonologist, private sector, 30 years' experience, Île-de-France).

[Calvignac 2023](#), Médecine du Sommeil

# Mechanical vs. Situated objectivity

## Mechanical objectivity

= evidence that is ‘uncontaminated by interpretation’

*Mechanical objectivity transforms life, in all its ambiguity and messiness, into something manageable*

“living *by* numbers”

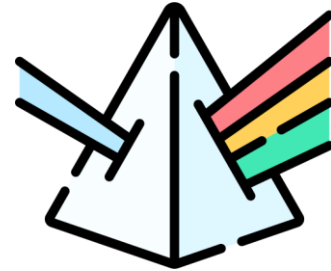


## Situated objectivity

= everyday x (mechanical objectivity + trained judgement)

*The objectivity that people apply to evaluating measurements transforms numbers and charts into ‘qualitative metrics’*

“living *with* numbers”



Some clinicians may use complementary, transparent, validated and contextualized objective assessments of symptoms



**For some patients**, some clinicians may use complementary, transparent, validated and contextualized objective assessments of symptoms

# To go further

## Align patient and clinician objectives

1

- B1.1: Patient motivation is not always obvious*
- B1.2: Misaligned objectives*

## Evaluate data quality

2

- B2.1: Unclear accuracy and reliability*
- B2.2: Data is often incomplete*
- B2.3: Data often lacks context*

## Judge data utility

3

- B3.1: Insufficient time*
- B3.2: Data can be irrelevant*
- B3.3: Data can be distracting*
- B3.4: Poor interoperability*

## Decide on a plan or action

6

- B6.1: Patient-generated data not considered concrete evidence*
- B6.2: Data use limited by practice or training*

## Interpret the data

5

- B5.1: Ambiguity in subjective data*
- B5.2: Unclear meaning of missing data*
- B5.3: Reliance on patient recall*

## Rearrange the data

4

- B4.1: Unfamiliar structure*
- B4.2: Unhelpful structure*

*[...] the GPs spend little or no time judging the quality of an app before suggesting it to the patients.*

*Note how Lene suggested apps when **the interface was nice and the app 'free'**, not based on an assessment of clinical relevance and validity*

*“Because I have tried to download it and it seems **manageable**. Ehm, and it is **purely random**.”*

*Despite suggesting a specific app, Benedicte apparently **considered the sleep apps on the market as equal**. She did not want to **spend time on analysing apps**, and she **was not paid to do so**.*

Instead of asking the people involved in a problematic situation, developers, educators, technologists and sociologists get their information about 'what these people really want and need' from theoretical studies carried out by their esteemed colleagues in what they think are the relevant fields. **Not live human beings, but abstract models are consulted; not the target population decides, but the producers of the models.**

Paul Feyerabend, *Against Method* (1975)



Heterogeneity of disorders

EPISTEMOLOGY

Interference with therapeutic relationship



SOCIOLOGY

Responsibility of clinician decision



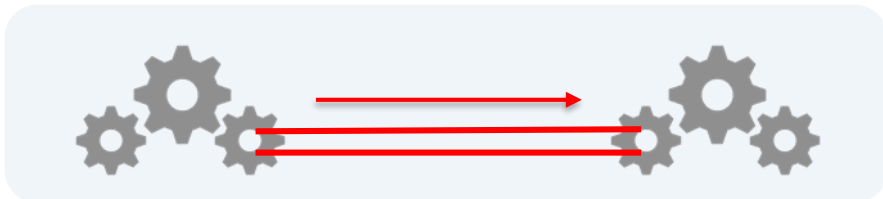
No improvement in follow-up



PSYCHIATRY



ETHICS



Voice biomarkers of DISORDERS

COMPUTER SC.

INNOVATION



Accessible



Regular



Ecological





Heterogeneity of disorders

Clinicians stay at the heart of the care



EPISTEMOLOGY

SOCIOLOGY

Supplementary information

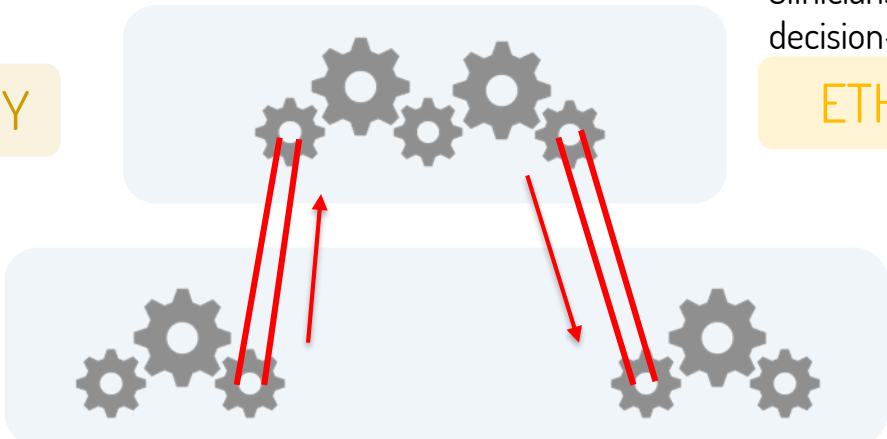


PSYCHIATRY

Clinicians remain decision-makers



ETHICS



Voice biomarkers of SYMPTOMS



COMPUTER SC.



Accessible



Regular



Ecological

INNOVATION



Improvement of the follow-up



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