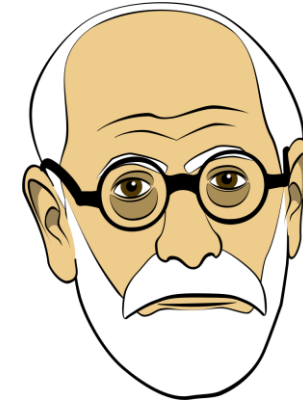




CREATING FREUD 2.0

USING REXX FOR AI



Mike Beer

REXX SYMPOSIUM 2020

mike@mindcoa.ch

AGENDA

- Why?
- History
- Artificial Intelligence & REXX
- Implementation
- Surprises & Wishlist

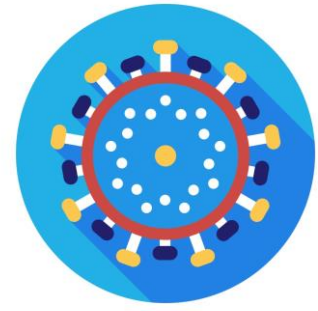
WHY?

PROBLEM

95% who need mental help
Do NOT receive it.
The 5% who do, get it
5 – 10 years too late. *)

*: EU Study 2010





CORONA CRISIS

The coronavirus pandemic is a game changer for mental health care

"There is a tremendous amount of anxiety right now, not just with people with preexisting conditions. We're seeing it across the board," said Dr. Leann Truehart, a Mandeville psychiatrist.

For people with severe or persistent mental illness, anxiety about COVID-19 – from fear of getting sick or of job loss and economic fallout – can exacerbate their condition and cause them to need more help, the professionals say.

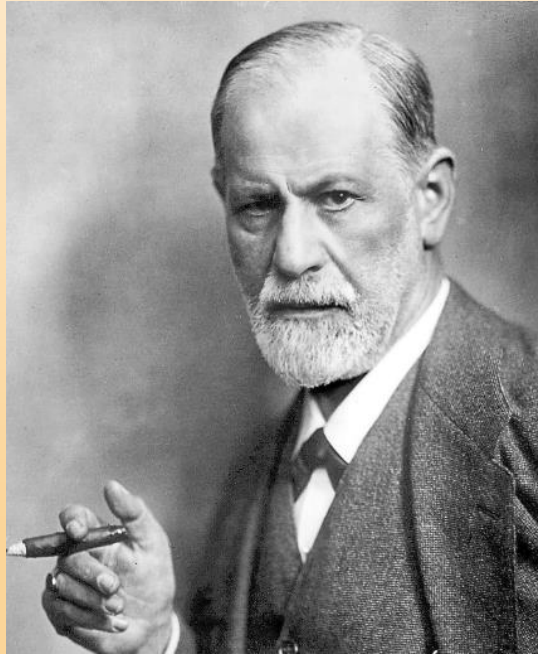
A recent [study from medical journal The Lancet](#) notes that the psychological impact of quarantine can be great, resulting in a range of mental health concerns from anxiety and anger to sleep disturbances, depression and post-traumatic stress disorder (PTSD). Indeed, separate studies of quarantined patients of SARS, a previous coronavirus outbreak in 2003, found [between 10% and 29%](#) suffered PTSD.

The Lancet's report found mental health concerns could be inflamed by stressors associated with quarantine, such as infection fears, frustration, boredom, inadequate supplies, lack of information, financial loss and stigma associated with contracting the disease.

That can be an issue not only for people with preexisting mental health concerns, but also those in seemingly good psychological health.

HISTORY

SIGMUND FREUD



Sigm. Freud

- born May 6, 1856, Freiberg, [Moravia](#), Austrian Empire [now Příbor, Czech Republic]
- died September 23, 1939, [London](#), England)
- Austrian neurologist and the founder of [psychoanalysis](#).

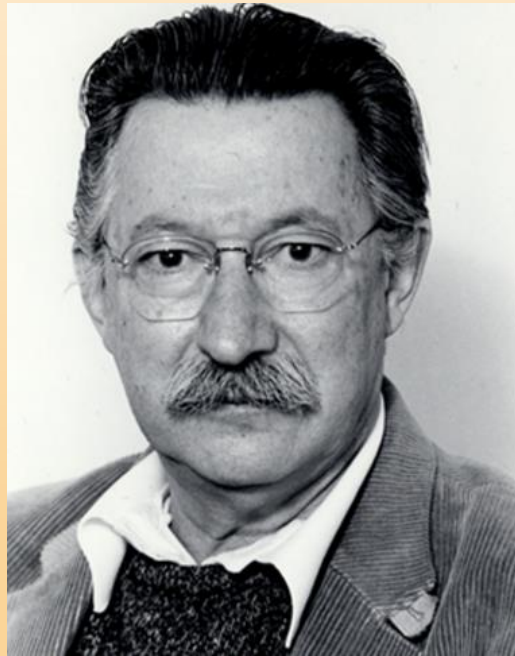
<https://www.britannica.com/biography/Sigmund-Freud>

SIGMUND FREUD



psychotherapy is
just an exchange of words

JOSEPH WEIZENBAUM



- German-born American computer scientist
- born Jan. 8, 1923, [Berlin](#), Germany
- died March 5, 2008, Gröben, Germany
- was a visiting professor at the [Massachusetts Institute of Technology](#)

<https://www.britannica.com/biography/Joseph-Weizenbaum>

ELIZA – FIRST CHATBOT

**ELIZA - A Computer Program for
the Study of Natural Language
Communication between
Man and Machine**
Joseph Weizenbaum
January, 1966
Volume 9, Number 1
pp. 36-45

bb 30-42

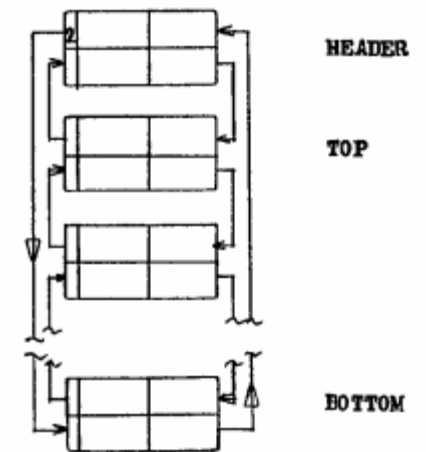
Men are all alike.
IN WHAT WAY
They're always bugging us about something or other.
CAN YOU THINK OF A SPECIFIC EXAMPLE
Well, my boyfriend made me come here.
YOUR BOYFRIEND MADE YOU COME HERE
He says I'm depressed much of the time.
I AM SORRY TO HEAR YOU ARE DEPRESSED

An ELIZA Script

```
(HOW DO YOU DO. PLEASE TELL ME YOUR PROBLEM)
START
(SORRY ((0) (PLEASE DON'T APOLIGIZE)
(APOLOGIES ARE NOT NECESSARY) (WHAT FEELINGS
DO YOU HAVE WHEN YOU APOLOGIZE) (I'VE TOLD YOU
THAT APOLOGIES ARE NOT REQUIRED)))
(DONT = DON'T)
(CANT = CAN'T)
(WONT = WON'T)
```

Symmetric List Processor

J. WEIZENBAUM
General Electric Co., Sunnyvale, Calif.*



A Simple List

IBM 7094



- IBM's last commercial scientific [mainframe](#) (built at a time when computers for scientific and business computing used separate [instruction sets](#)).
- It had about 1.4-2.4 times the computer power of its predecessor, the [IBM 7090](#). It was upwardly compatible with the 7090, but did have extra [index registers](#) (going from three to seven), and hardware double-precision [floating point](#) support.
- It appeared in two models: the original 7094 (sometimes known as the 7094 I); and the 7094 II, announced in May, 1963, with the first installation in April, 1964.
- The latter had about twice the speed of the original; due in part to the introduction of [pipeline](#) techniques (pioneered by the [IBM 7030 Stretch](#)), but also a slightly faster [clock](#).
- Total production amounted to 130 7094 I's, and 125 7094 II's.

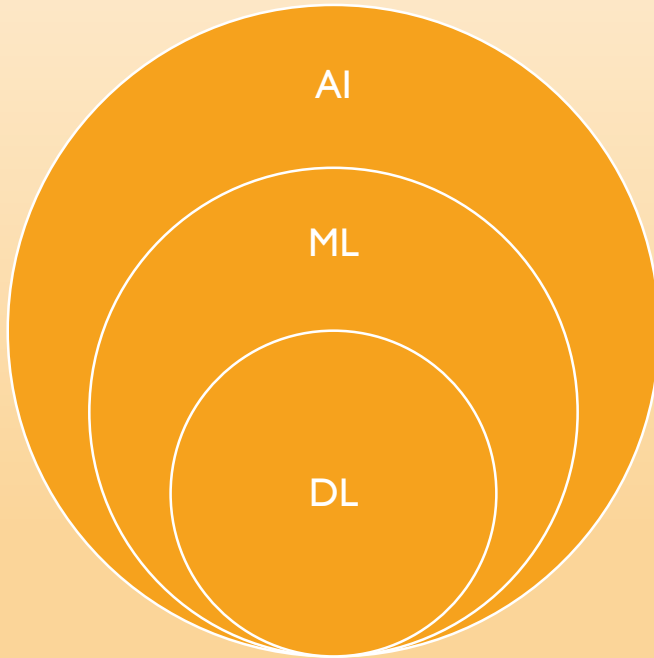
MAD PROJECT (1963)



- Explore development and use of time-sharing
- Development of a next-generation time-sharing system called [Multics](#).
- CTSS was to be used as the programmers' tool to develop this new system, as well as the tool to support other research projects, such as database and language research. The Director of Project MAC was MIT Professor [Robert M. Fano](#)
- <https://www.slideshare.net/sebastianwoinar/ctss-compatible-time-sharing-system>
- <https://multicians.org/thvv/7094.html>
- <https://www.youtube.com/watch?v=sjnmcKVnLi0>

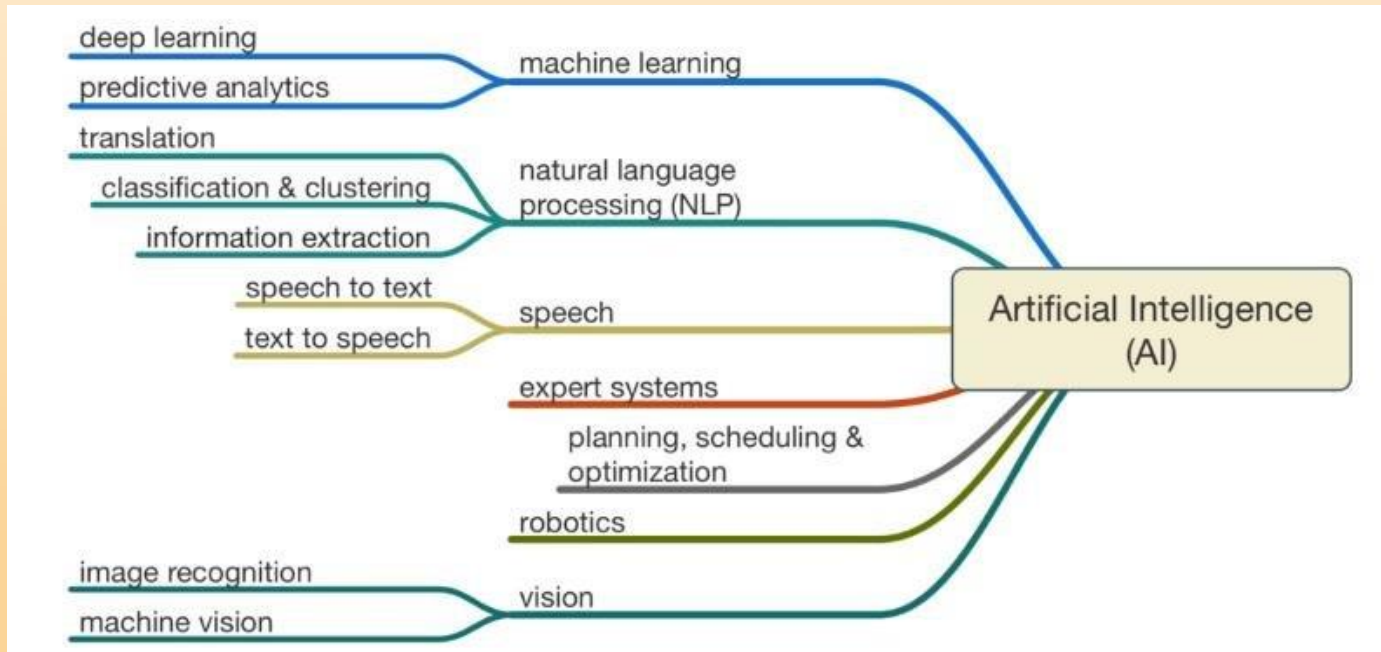
ARTIFICIAL INTELLIGENCE WITH REXX

AI = MACHINE/DEEP LEARNING?



- Machine Learning:
 - learn without explicitly being programmed
- Deep Learning:
 - Think like humans
 - Neural Networks

AI OVERVIEW



WHY DOES THERAPY WORK? COMMON FACTORS (GRAWE)

- Focus on specific issues of the patient
- Activation of resources within the patient
- Addressing and solution of specific problems
- Analysis of problem causes
- Therapeutic relationship



DIGITAL TRANSLATION

- **Therapist: Rogers-Variables**

- 1. Empathy
- 2. Unconditional positive regard
- 3. Authenticity



Patient

Willingness to work with online app

Change Process

within the client

Treatment Structure

more sessions
more flexibility
additional material

Relationship

Online-Therapy vs. Face 2 Face

5 MAIN FACTORS GRENCAVAGE UND NORCROSS (1990)

- Properties of the Therapist 21%
- Properties of the Patient 6%
- Change Processes 41%
- Treatment Structure 17%
- Therapeutic Relationship 15%

WAMPOLD-CRITERIA

#	Therapist		
1	Interpersonal Skills (empathy, warmth, verbal fluency..)	8	Flexible, adjusts therapy
2	Clients feel understood, trust the therapist	9	Addresses difficult material
3	Working alliance: therapeutic bond & agreement on goals	10	Communicate hope and optimism
4	Provide explanations	11	Awareness of client's characteristics & context
5	Provide treatment plan	12	Aware of own psychological process („Gegenübertragung“)
6	Influential, convincing	13	Use best research evidence
7	Monitor progress	14	Seeks to continually improve.

SOME STUDIES ON INTERNET-INTERVENTIONS

Hoermann, S., McCabe, K. L., Milne, D. N., & Calvo, R. A. (2017). Application of Synchronous Text-Based Dialogue Systems in Mental Health Interventions: Systematic Review. *Journal of medical Internet research*, 19(8), e267. doi:10.2196/jmir.7023

Enam A, Torres-Bonilla J, Eriksson H (2018): Evidence-Based Evaluation of eHealth Interventions: Systematic Literature Review. *J Med Internet Res* 2018;20(11):e10971; <http://www.jmir.org/2018/11/e10971/>

Rost T, Stein J, Löbner M, Kersting A, Luck-Sikorski C, Riedel-Heller SG: User Acceptance of Computerized Cognitive Behavioral Therapy for Depression: Systematic Review *J Med Internet Res* 2017;19(9):e309; <http://www.jmir.org/2017/9/e309/>

Seyffert M, Lagisetty P, Landgraf J, Chopra, V, Pfeiffer PN, Conte ML, et al. (2016): Internet-Delivered Cognitive Behavioral Therapy to Treat Insomnia: A Systematic Review and Meta-Analysis. *PLoS ONE* 11(2): e0149139. doi:10.1371/journal.pone.0149139

Richards et al. (2015): The efficacy of internet-delivered treatment for generalized anxiety disorder: A systematic review and meta-analysis in: *Internet Interventions*

Tulbur (2011): The efficacy of Internet-supported intervention for social anxiety disorder: A brief meta-analytic review. In: *Procedia - Social and Behavioral Sciences* 30 (2011) 552 – 557

Nesvåg S, McKay JR (2018): Feasibility and Effects of Digital Interventions to Support People in Recovery From Substance Use Disorders: Systematic Review in: *J Med Internet Res* 2018;20(8):e255; <http://www.jmir.org/2018/8/e255/>





next

CHAT

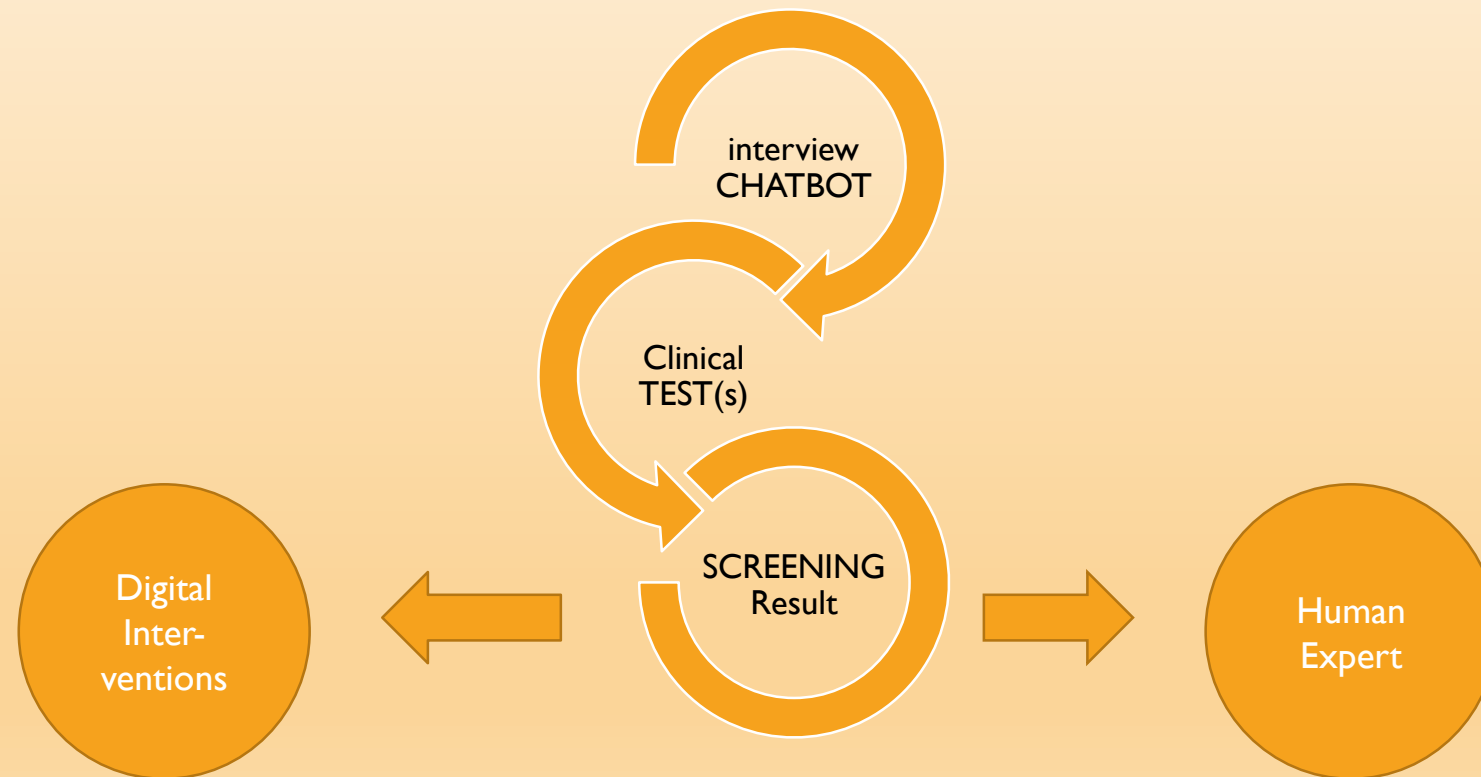
Do you want to talk about a specific topic?

v

send

exit

SAMPLE WORKFLOW

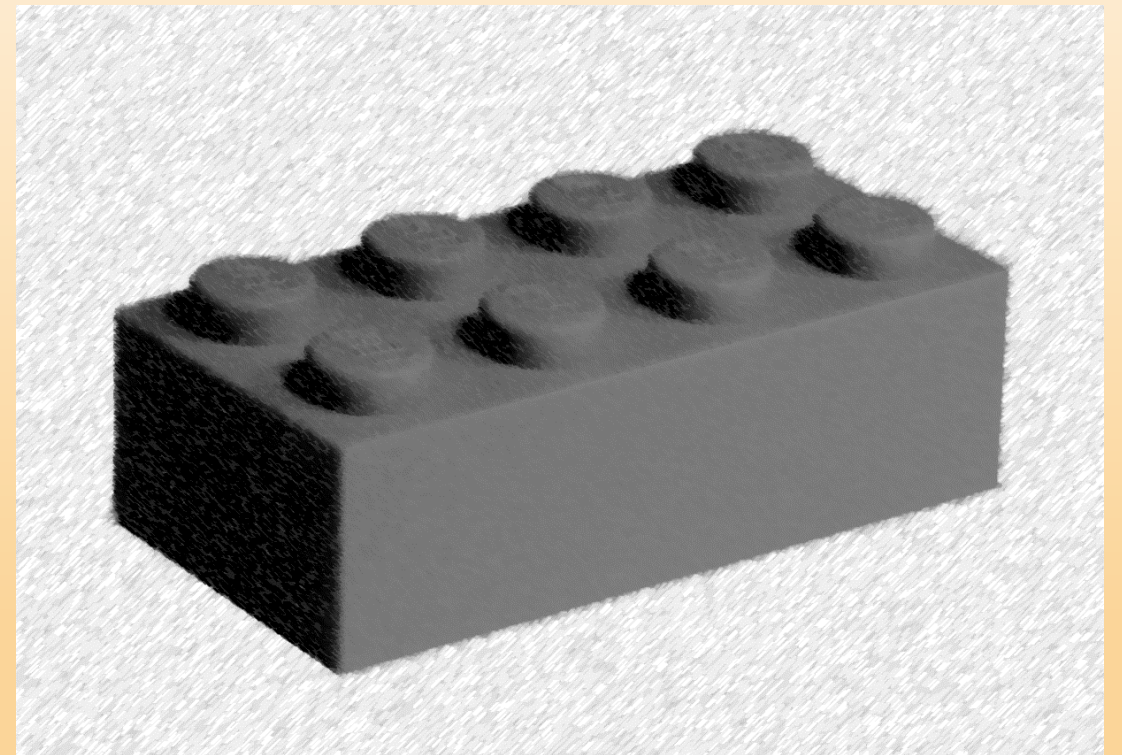


SOME AI FUNCTIONS

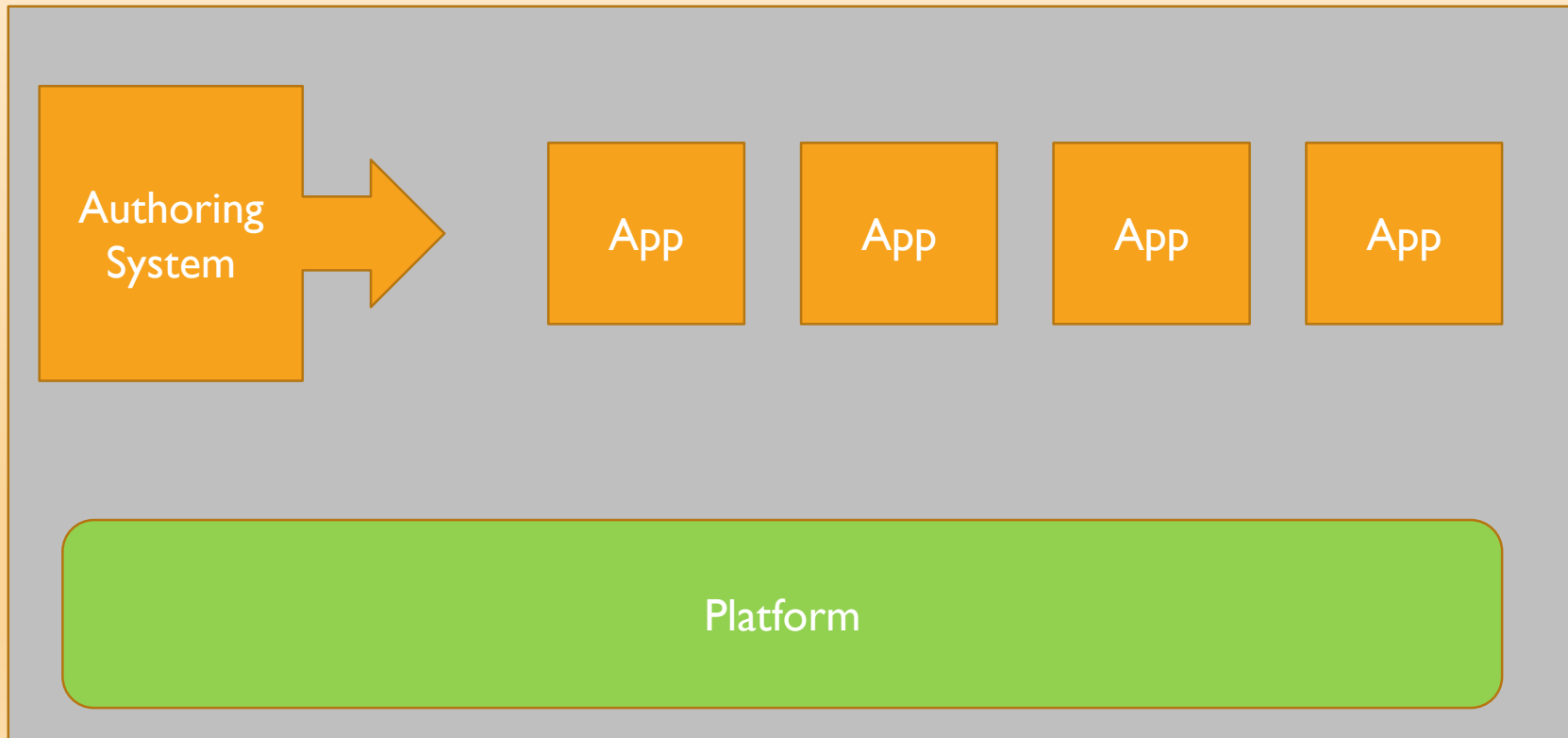
- **Audio:**
 - - Text to Speech
 - - Speech to Text (Voice Recognition)
- **Chatbot**
- **Summarize Texts**
- **Natural Language Understanding – understand sentiments**
- **BeyondVerbal – Voice Stress Analysis**
- **Fitbit – biometric data**
- **SimyLife - stress data**

BUILDING BLOCKS

- TEST: perform a test -e.g. with LIKERT scale
- INTERVIEW: chatbot with virtual coaches
- REPORT: display results
- VIDEO: play a youtube video
- FORM: input form
- IMAGE: display one or more images
- INFO: display text page
- MENU: structure flow within app
- Direct ACCESS to coach
- SCRIPTING LANGUAGE FOR INTEGRATION



OVERVIEW



SOFTWARE STACK

CLIENT

- Browser
- HTML5
- Javascript
- Several libs
 - E.g. JQueryMobile

SERVER

- WIN/LINUX
- REGINA
- APACHE with REXX interface
- Own Framework
- Database
 - MARIADB

CALLING AI FUNCTIONS

- HTTP(S) calls
- Websockets
- REXX Functions

TEXT TO SPEECH STRING → MP3

IBM

```
outfile_mp3=tmpfile(".mp3")
cmd='curl -X POST -u "'user':'pw'",
'--header "Content-Type: application/json",
'--header "Accept: audio/mp3",
'--data '{"text":"'text'"}',
'--output' outfile_mp3,
"'url'/v1/synthesize?voice='voice'"
address command cmd with output stem out. error
stem err.
files=xmlput("mp3",outfile_mp3)
```

READSPEAKER

```
url = "https://tts.readspeaker.com/a/speak"
data = "--data key="apikey,
"--data lang="lang,
"--data voice="voice,
"--data "text='text'"
address command "curl -L -o" outfile_mp3
url data
files = xmlput("mp3",outfile_mp3)
```

SPEECH TO TEXT

- Endpoint in CLIENT
e.g. Web browser
- → JAVASCRIPT
- Generation of client code on server →

when language="de-DE" then do

```
script=readfile("msasr.ctl")
```

```
script=changestr("$language;",script,language)
```

```
script=changestr("$output;",script,output)
```

```
script=changestr("$wait;",script,wait)
```

```
end
```

ATTENTION ON EXTERNAL FUNCTIONS



- Documentation often misleading/missing
- keep on changing very often
 - Functionality and
 - Interface (API)
- Expect downtime (not 5 NINES)
- no systems management API / notification
- Usually no planning information

SAMPLE QUESTION

Auf einer Skala von 1 (nicht gut) bis 10 (sehr gut) - wo stehst Du?

5



ok

exit

QUESTIONNAIRE PROCESSING

```
s = getitems(token,testname)
```

```
ret = dsput(token,"s",s)
```

```
GOAL = sum(pick(s,4 6 8 11))
```

```
TASK = sum(pick(s,1 2 10 12))
```

```
BOND = sum(pick(s,3 5 7 9))
```

```
ret = mind("&cmd=put user" user "WAI" ,  
xmlput("GOAL",GOAL),,
```

```
xmlput("TASK",TASK),
```

```
xmlput("BOND",BOND))
```

- APL:

```
GOAL ← +/ s[4 6 8 11]
```

```
TASK ← +/ s[1 2 10 12]
```

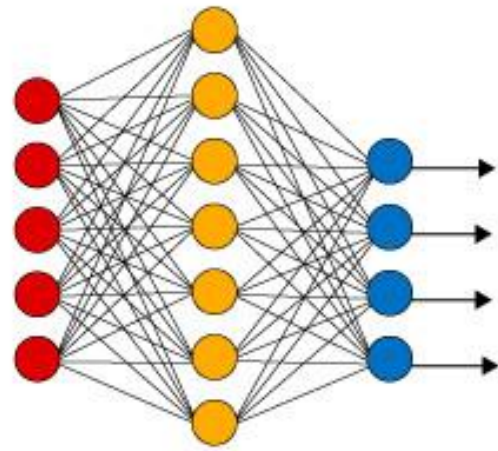
```
BOND ← +/ s[3 5 7 9]
```

Open Source APL2:

<http://nars2000.org/>

MACHINE LEARNING IN REXX

Simple Neural Network

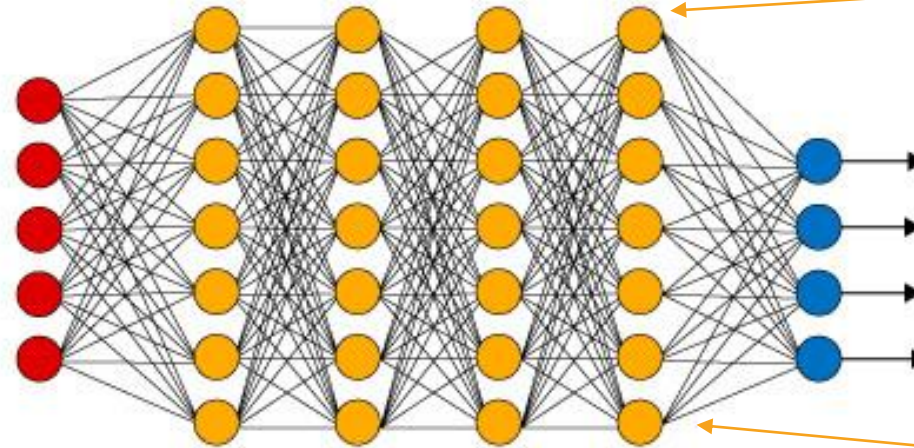


● Input Layer

● Hidden Layer

● Output Layer

Deep Learning Neural Network



WEIGHT

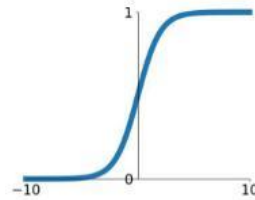
ACTIVATION
FUNCTION

MACHINE LEARNING IN REXX

Activation Functions

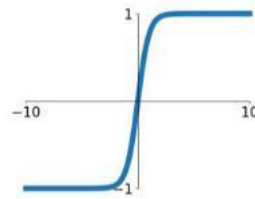
Sigmoid

$$\sigma(x) = \frac{1}{1+e^{-x}}$$



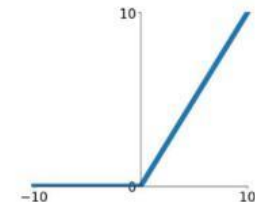
tanh

$$\tanh(x)$$



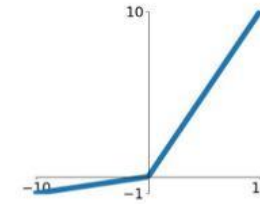
ReLU

$$\max(0, x)$$



Leaky ReLU

$$\max(0.1x, x)$$

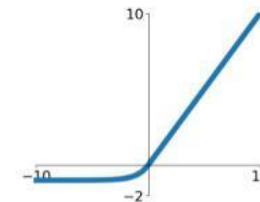


Maxout

$$\max(w_1^T x + b_1, w_2^T x + b_2)$$

ELU

$$\begin{cases} x & x \geq 0 \\ \alpha(e^x - 1) & x < 0 \end{cases}$$



AI WISHLIST

FUNCTIONS

- Roots & rational exponents
- Trigonometric functions
- `Iff(cond,a,b)`

- `List=,a + b; x/y;3.14“`
- `Say word(list,2,“;“)`

VARIABLES

- Real lists
- APL2-Variables and
 - Functions/operators on them

PERFORMANCE

- Preloading of external functions (macro space)
- Rexx compiler

QUESTIONS

- RxSock 64bit version (REGINA)?
- Coexistence ooREXX & REGINA in production environment
- Migration from Regina to ooRexx?
- Future of Regina?
- (oo)REXX roadmap?

THANK YOU

Special thanks to MFC for creating a wonderful language