Life Improvement Science

Dr. Falk Lieder
Max Planck Research Group Leader

Rationality Enhancement Group
Max Planck Institute for Intelligent Systems, Tübingen
Life Improvement

Cognitive Foundation

Technological Foundation

Socio-Cultural Foundation
Cognitive Foundation

Goal Setting

Meta-Control
Beliefs & Attitudes

Metacognitive Learning

Goal Pursuit
I. Intelligent Tutors

II. Find Your Path

III. Digital Companions

Goal Setting

Goal Achievement

Self-Improvement
People learn how to think and how to decide

metacognitive learning
What are the brain’s algorithms for metacognitive learning?
How do people learn how to plan?

\[ \pi_{(0)} \]

\[ \pi_{(1)} \]

\[ \pi^{*} \text{meta} \]
Process Tracing: Making Planning Observable

Clicking on a node reveals its value for a $1 fee. Move with the arrow keys.

(Callaway¹, Lieder¹, Krueger¹, & Griffiths, 2018)
An environment where long-term outcomes are most important

Clicking on a node reveals its value for a $1 fee.
Move with the arrow keys.
Cognitive Tutors

Metacognitive Reinforcement Learning

cognitive strategy

Problem

Optimal Feedback

Cognitive Tutor

13
Clicking on a node reveals its value for a $1 fee.
Move with the arrow keys.
Faster Learning --> Better Planning

Learning Curves in Training Block

Performance in the Post Test
Training Task  ➔  Transfer Task

Clicking on a node reveals its value for a $1 fee.
Move with the arrow keys.

Clicking on a node reveals its value for a $1 fee.
Move with the arrow keys.
Transfer Effects

Performance on the Transfer Task

Avg. Score (points/trial)

Control

Cognitive Tutor
Adding instruction about effective strategies

Is it on the highest level among unobserved nodes?

Yes

Did the previous click uncover a 48?

Yes

DON'T CLICK IT

No

DON'T CLICK IT

No

CLICK IT

DON'T CLICK IT
Leveraging AI to improve how people plan

Metalevel RL

Optimal cognitive strategies
Deriving descriptions of optimal strategies automatically

\[ \pi^*_{\text{meta}} \]

optimal metalevel policy

流图

可解释决策规则

AI-Interpret
Promoting Metacognitive Learning with Reflection Prompts
1. Plan

2. Act

Clicking on a node reveals its value for a $1 fee.
Move with the arrow keys.
Please complete the following statements:

How did you decide what to do in the most recent rounds? I did...

How did it work out? It worked out...

Why did it turn out that way? It turned out that way, because...

3. Reflect
Please consider the rewards of the last trial and complete the following statements:

What would have happened if you had chosen a strategy that evaluated the end states first in the latest round? It would have...

How would it have worked out? It would have worked out...

Why would it have turned out this way? It would have turned out this way, because...

3. Reflect
Score on transfer task

control

prompt
Take Home Message 1

Intelligent cognitive tutors can help people overcome their biases and learn how to make better-informed decisions.
I. Intelligent Tutors

II. Find Your Path

III. Digital Companions

Goal Setting

Self-Improvement

Goal Achievement
Values

Value-Based Goal-Setting

Long-term goals

Hierarchical Goal-Setting

Mid-term goals

Self-Concordance

Short-term goals

Goal Network Congruence

Daily Goals
Value-Based Goal-Setting

Olive
I will now show you several questions to help you reflect about your most important life goals. Please choose the question you like best and then take a minute to reflect on it. Remember, taking the time to honestly think about these questions is for your benefit! Click on the question and continue to reflect on it.
16:00:49

1. What do you want to make sure you do, achieve, or experience before you’re gone?

2. What is the most important thing that you know you really should do but that you have trouble getting yourself to do?
Value-Based Goal-Setting

1. What do you want to make sure you do, achieve, or experience before you’re gone?

Olive
Now take a moment to honestly to reflect on what your most honest answer to this question would be. You will be able to proceed in one minute.

Olive
Are you ready to keep going?

I'm ready
Value-Based Goal-Setting

Olive
Based on your reflection, which ultimate life aspiration would you like to define for yourself? Please enter it in the text box.
09:28:39

Cure cancer
09:29:02
Hierarchical Goal-Setting

Olive
Which goal would you like to set for yourself to make reaching your ultimate life goal more likely to happen sooner?
17:58:14

Get into Med School
17:58:24

Olive
How much time do you think it will take you to reach this goal?
17:59:09

About 6 months
17:59:30
Hierarchical Goal-Setting

Great! Now that you have imagined what you want to achieve in six months, take a moment to think about where you would like to be halfway to your goal. Write down the outcome you want to achieve by the time you get to three months.

18:00:10

I want to have researched the Top 10 Med Schools and want to have sent at least 5 applications.

18:00:45

Awesome, this is your first milestone! Creating milestones is an effective way to break down your long-term goals into actionable next steps.

18:00:51
Hierarchical Goal-Setting

Olive
Alright, let's create another milestone! I'd like you to imagine what successfully completing your milestone in three months would look like. Where would you be? How would it feel? Imagine it fully. You will be able to continue in about 30 seconds. 18:01:41

...
The resulting long-term goals reflect the person’s values and identity.

$F(2, 145) = 4.50, \ p = .01, \ \eta^2 = .06$
The resulting goals are more congruent with each other.

\[ F(2, 176) = 6.85, \ p < .01, \ \eta^2 = .07 \]
Take Home Message 2

Chatbots can be used to help people set meaningful long-term goals and break them down into actionable intentions.
Goal Setting

II. Find Your Path

II. Find Your Path

III. Digital Companions

I. Intelligent Tutors

Self-Improvement

Goal Achievement
People often fail to do what is best in the long-term when it is unpleasant in the short-term.
Making good decisions easier by **aligning** short-term reward with **long-term value**

**Goal**: Add incentives $f$ so that the short-sighted decision becomes optimal:

$$\arg \max_a \mathbb{E}[r(s, a, s') + f(s, a)] = \pi^*(s)$$

**Solution:**

$$f(s, a) = \gamma \cdot \mathbb{E}[V^*(S')|s, a] - V^*(s)$$
To-Do List Gamification

\[ f(s, a) = \gamma \cdot \mathbb{E}[V^*(S')|s, a] - V^*(s) \]

1. Requirements Planning +50
2. Back-end Work
   1. Install CMS +10
   2. Upgrade database
3. Front-end Work
   1. Logo Design +10

https://todo-gamification.herokuapp.com/
To-Do List Gamification

Activity Display

Aborted

Persistence is key

Writing Assignment 1

Level: 1
Points: 0

How has North Korea's economic policy changed since the 1950s? What are the reasons and implications of these changes?

Your text should be original and of the highest quality, and you have to write at least 100 words. If you copy from a different source, then your submission will be rejected.
To-Do List Gamification Alleviates Procrastination

p<.001

Welcome, Elon!

There are 10 tasks in total and you may complete as many or as few as them as you like. Writing Assignments 2, 3, 6, 8, and 10 belong to Project 1 and Writing Assignments 1, 4, 5, 7, and 9 belong to Project 2. To complete a project you have to submit original high-quality essays for all of its assignments. If you complete both projects by the deadline, Proportion of People wasting time on the unimportant project is 32.6% and Proportion of People wasting time on Project 2 but not Project 1 is 41.9%. A bonus of $1 is earned by completing both projects by the deadline. The deadline is on February 11 2019 at 12am Pacific Time (midnight).

\( \chi^2 (2) = 10.85, p = .004 \).
Take Home Message 3

We can leverage AI and gamification to repair broken incentive structures to help people overcome procrastination and make better decisions.

Good job staying off Facebook.
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Self-Improvement

Goal Achievement
First steps towards putting it all together
Violet: What do you want to make sure you do, achieve, or experience before you’re gone?

Violet: Great! How long will it take you to achieve this goal?

Violet: On a scale from 1 to 10, how important is this goal to you?

Violet: Great! You’ve set your first life goal! It will be stored in a hierarchical list, allowing you to arrange your goals and subgoals better!

Violet: I will show you in a second!
Progress bar
Points: 170/1170, 15% achieved

To-Do List
- Intention 1 [Goal 1] | 70 points | 1H | Tomorrow
- Subgoal 1 | Intention 1 [Goal 2] | 100 points | 1h | Sep. 25th
- Intention 4 [Goal 1] | 200 points | 30 Min | Sep. 28th
- Onboarding tutorial | 500 points | 10 Min | Tomorrow
- Goal setting how to achieve Goal2 subgoal? | 300 points | 20 Min | Tomorrow

Next fish tank addition:
Baby Nemo
(4370 of 5000 points)
Restructuring the work environment to help people learn to focus their attention

Rationality Enhancement: Towards theories and tools for helping people become more effective
Human judgment and decision-making appear to be riddled with numerous systematic errors. Previous attempts to attenuate these so-called cognitive biases by educating people about them or schooling them in the laws of logic, probability theory, and expected utility theory have had limited success. In this talk, I will outline an alternative approach to improving human rationality. Rather than trying to solve what it means to be rational, I will illustrate how making Herbert Simon’s notion of bounded rationality mathematically precise allows us to derive optimal decision strategies from first principles. In the second part of my talk, I will discuss how this approach can be implemented in practical tools and applications.
Wednesday 7

1) work on the LIS manifesto

1★★) process Mike's feedback on my sections of the LIS manifesto #week-41-2020 #priority

-1★★) think about updating the questions of the LIS manifesto #week-41-2020 #priority

-1★★) make a plan for how to revise the LIS manifesto until the end of October #week-41-2020 #priority

-1★★) read the current draft of the LIS manifesto #week-41-2020 #priority

-1) update Section 4 in the light of the changes in Sections 1-3 #week-41-2020

-1) plan updating Section 6 #week-41-2020

Reflect on Study optimal living

What were your goals for this week and how did it go?

Have you made enough progress towards this goal this week?

What are your monthly priorities for this goal?

What are your goals for next week? 🌈
Effective Living

Cognitive Foundation

Technological Foundation

Socio-Cultural Foundation
Collaborators and Former REG Members

- Laura Bustamante
- Fred Callaway
- Jon Cohen
- Peter Dayan
- Lisa Eckerstorfer
- Ella Eisemann
- Spencer Greenberg
- Tom Griffiths
- Sanit Gupta
- Anirudha Kemptur
- Paul Krueger
- Aashay Mehta
- Florian Mohnert
- Sebastian Musslick
- Bastian Nowozimski
- Malcolm Ocean
- Viktoria Pammer-Schindler
- Vasundhara Rakesh
- Lennart Scatturin
- Amitai Shenhav
- Jugoslav Stojcheski
- Joseph Williams
- Maria Wirzberger
- Lin Xu

https://re.is.mpg.de
Conclusions

• Cognitive tutors and intelligent productivity apps can help people *overcome* procrastination and improve themselves.

• Advances in artificial Intelligence present unprecedented opportunities to empower people.

• To fully realize these opportunities, we need *Life Improvement Science*. 