Target Driven Activity Planning

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TRB 2012 (12-1611)

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Research Question

How can we ***continuously generate and schedule activities*** *under the constraints of* ***behavioral realism*** *and* ***algorithmic efficiency****?*

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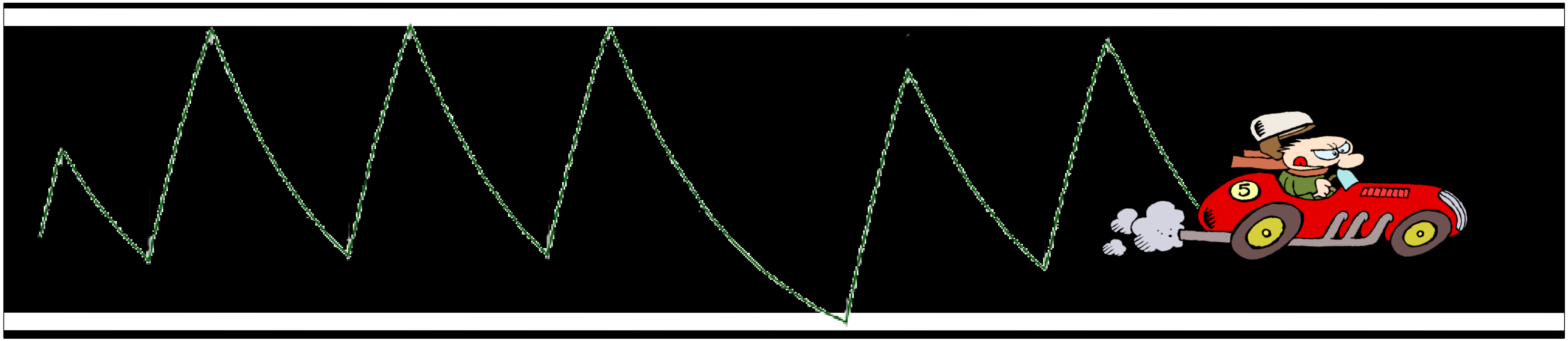
How can we ***continuously generate and schedule activities*** *under the constraints of* ***behavioral realism*** *and* ***algorithmic efficiency***?

- Agents make decisions *on the fly* with an *open time horizon* (multiday)
- Use parameters that are close to observed behavior
- Use a *decision heuristic* (greedy as-we-go approach) and go parallel

Overview

- Components of our model
  - Targets
  - Projects
  - Effectiveness
- Decision heuristic
- Q&A

Targets



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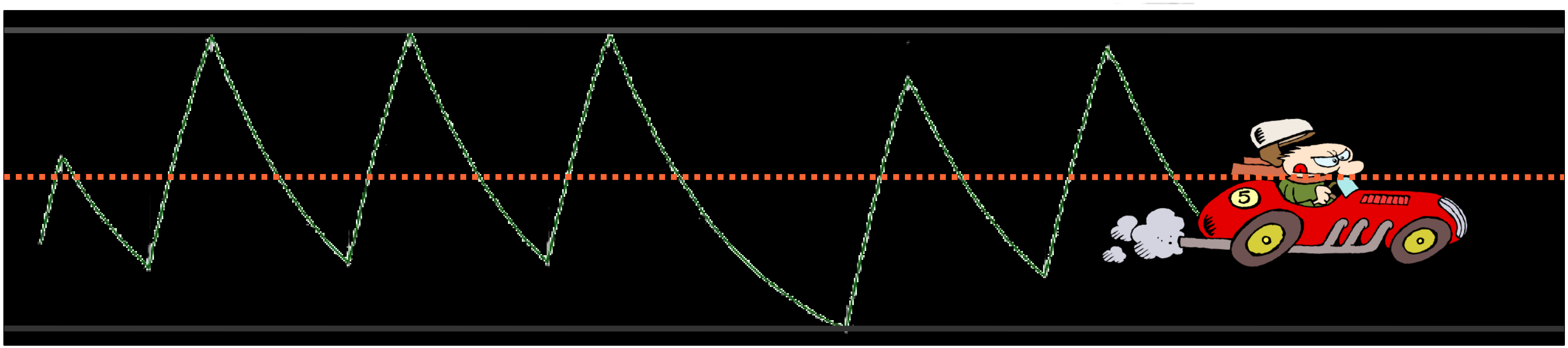

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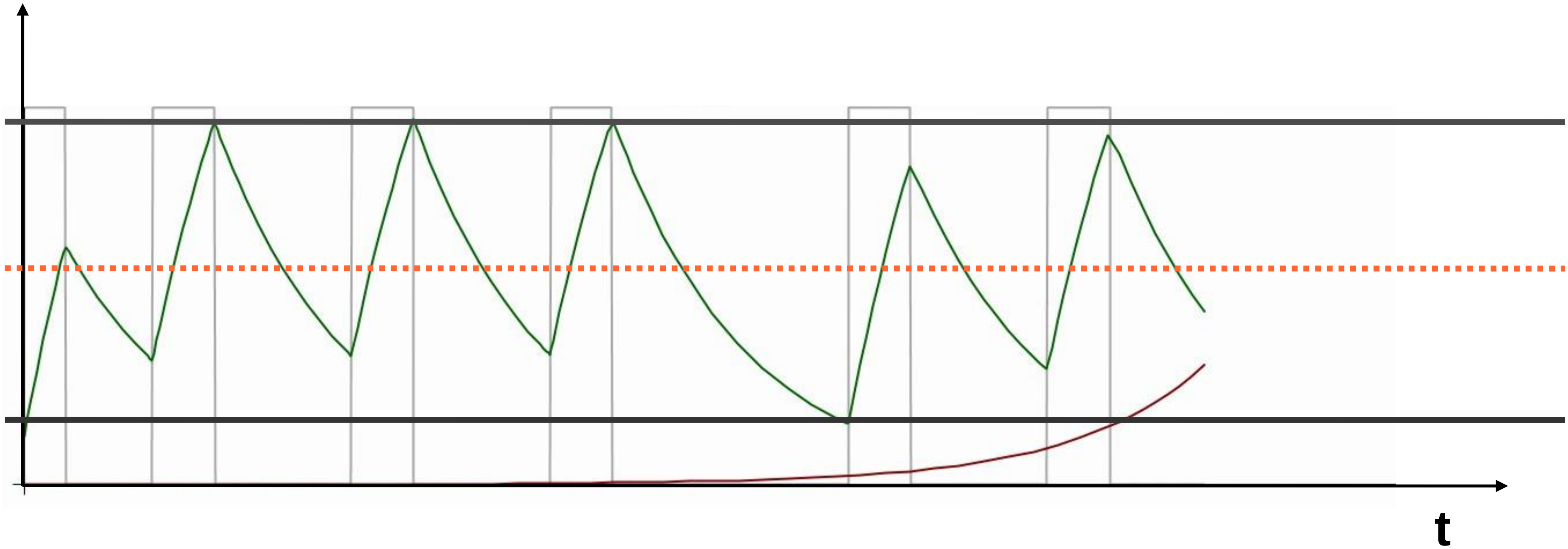

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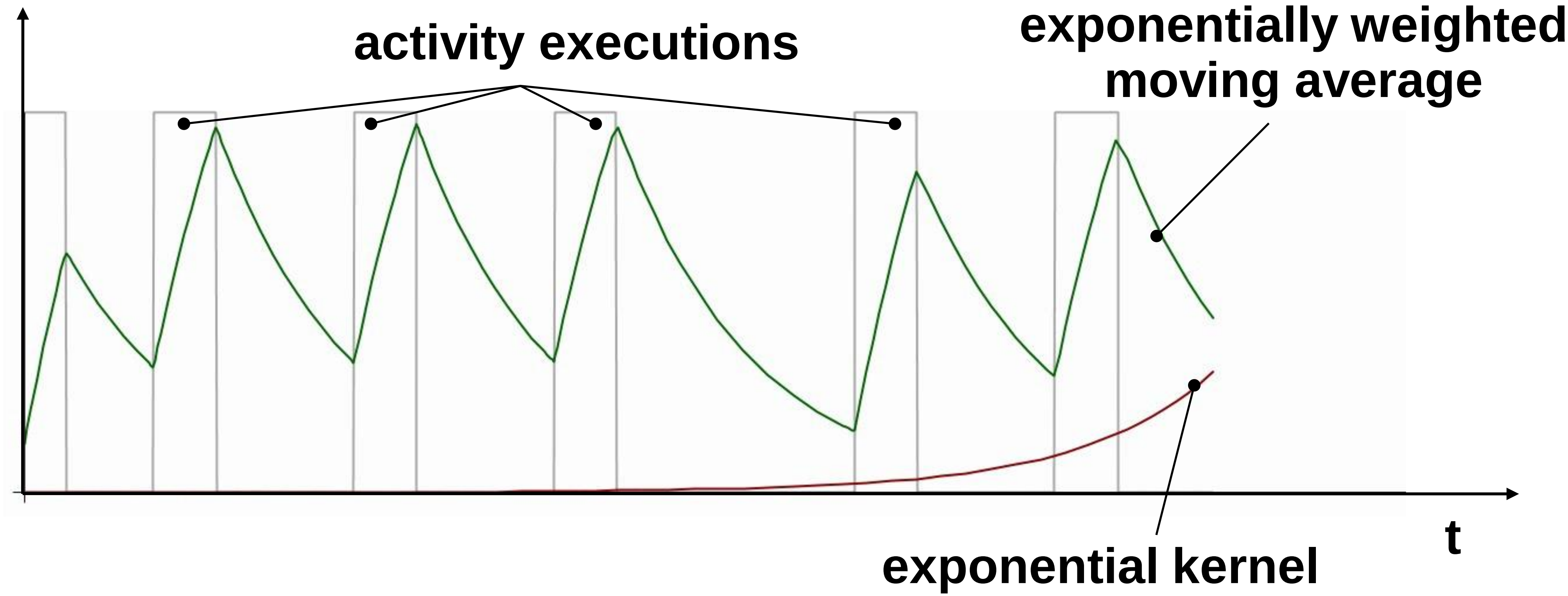
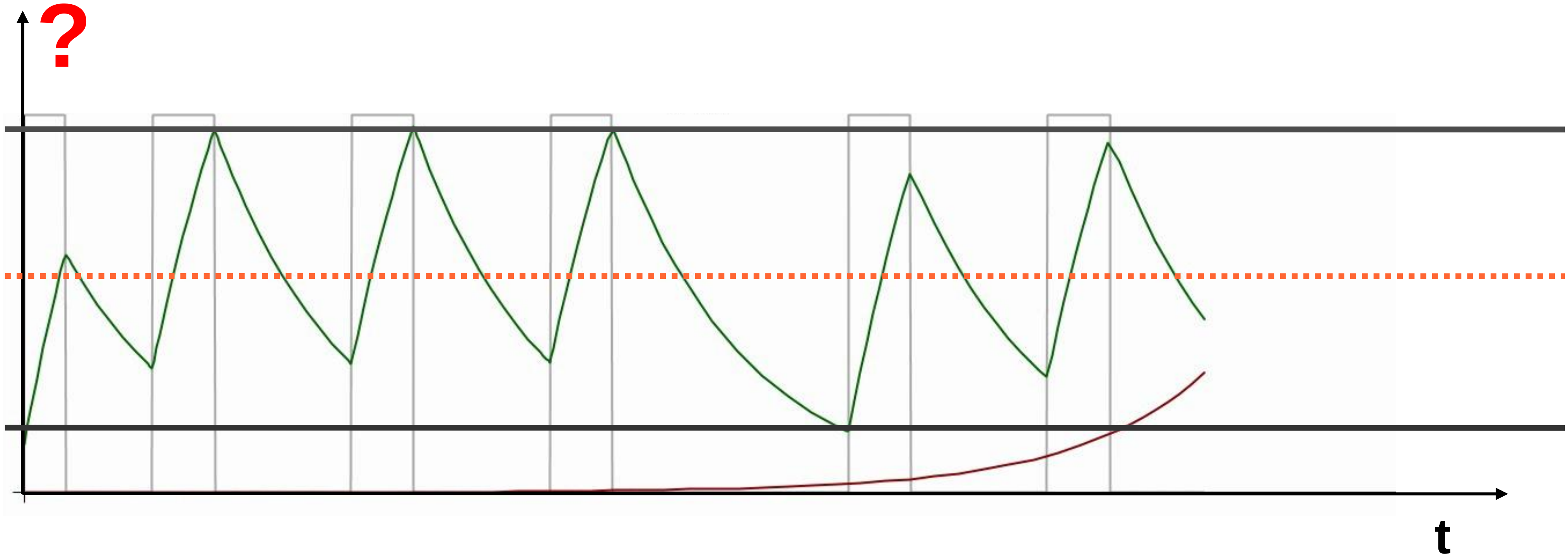


Convolution with an exponential kernel

➔ exponentially weighted moving average

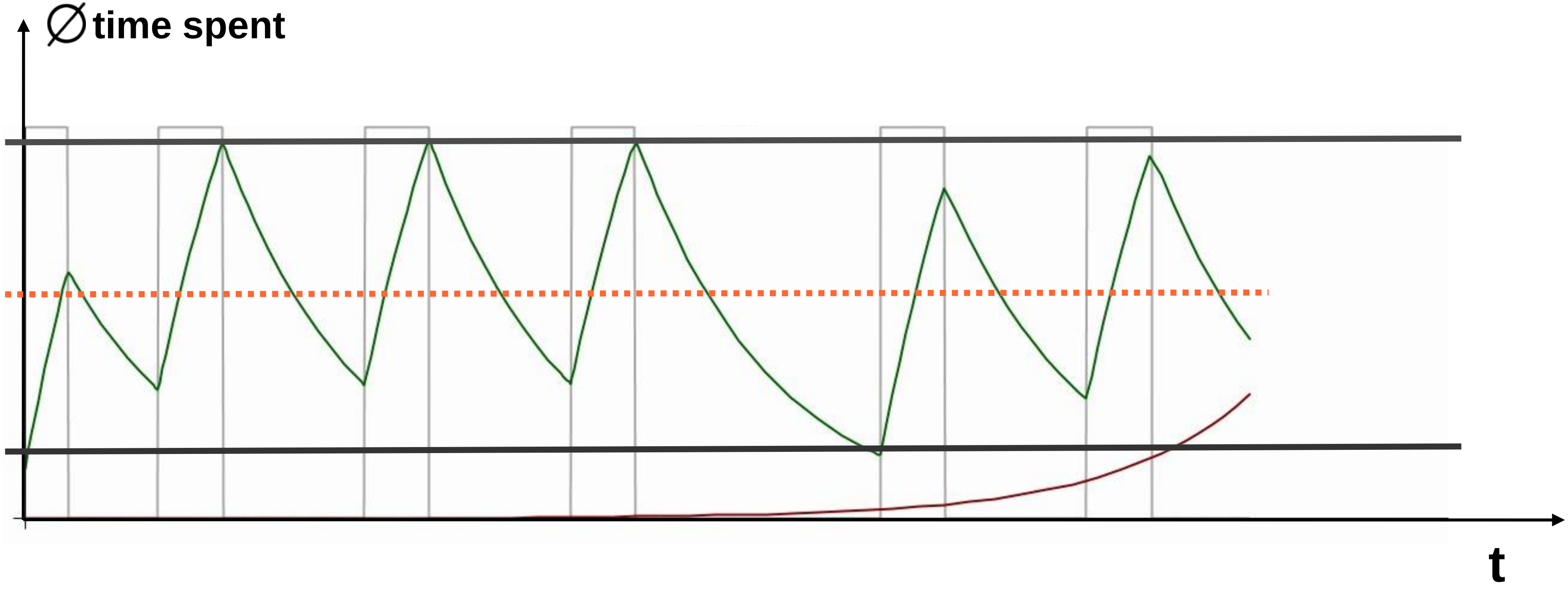
Targets



Possible values:

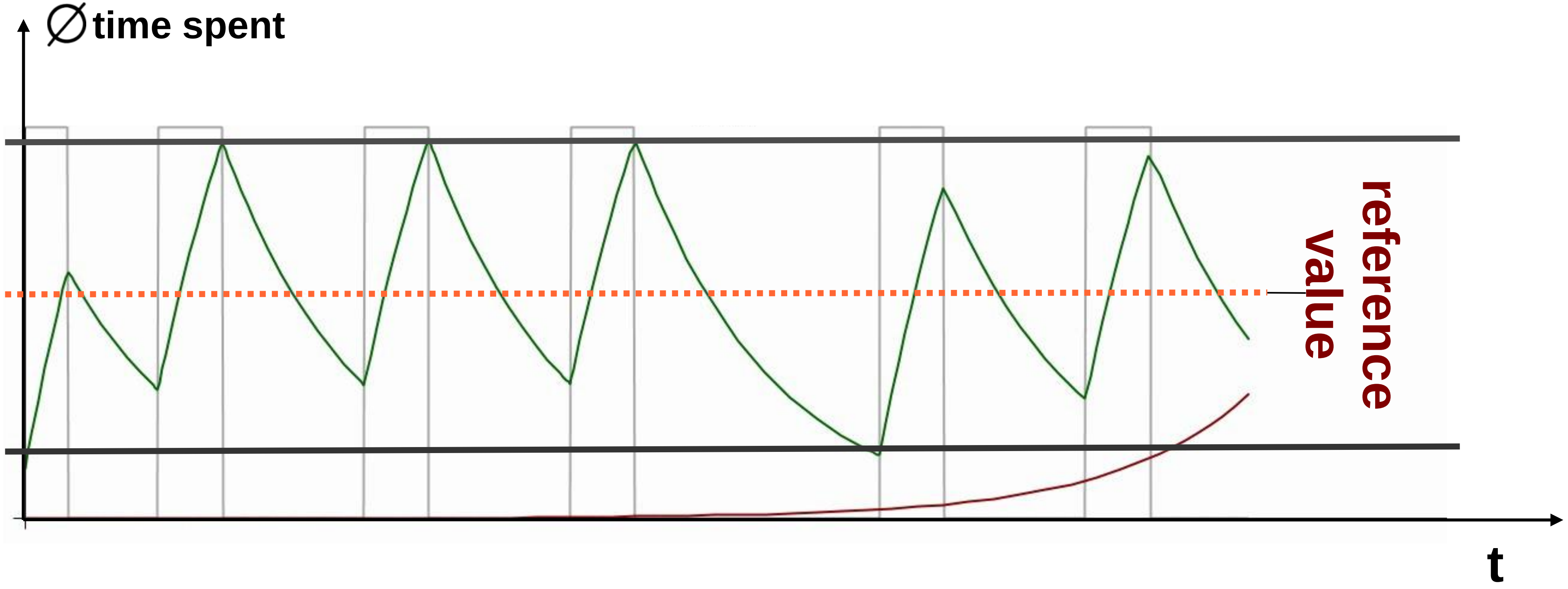
- Average time spend for an activity
- Average execution frequency of an activity

Targets



A person would like to play $2^{+0.5}_{-1}$ hours of tennis about 2^{+1}_{-1} times per week.

Targets



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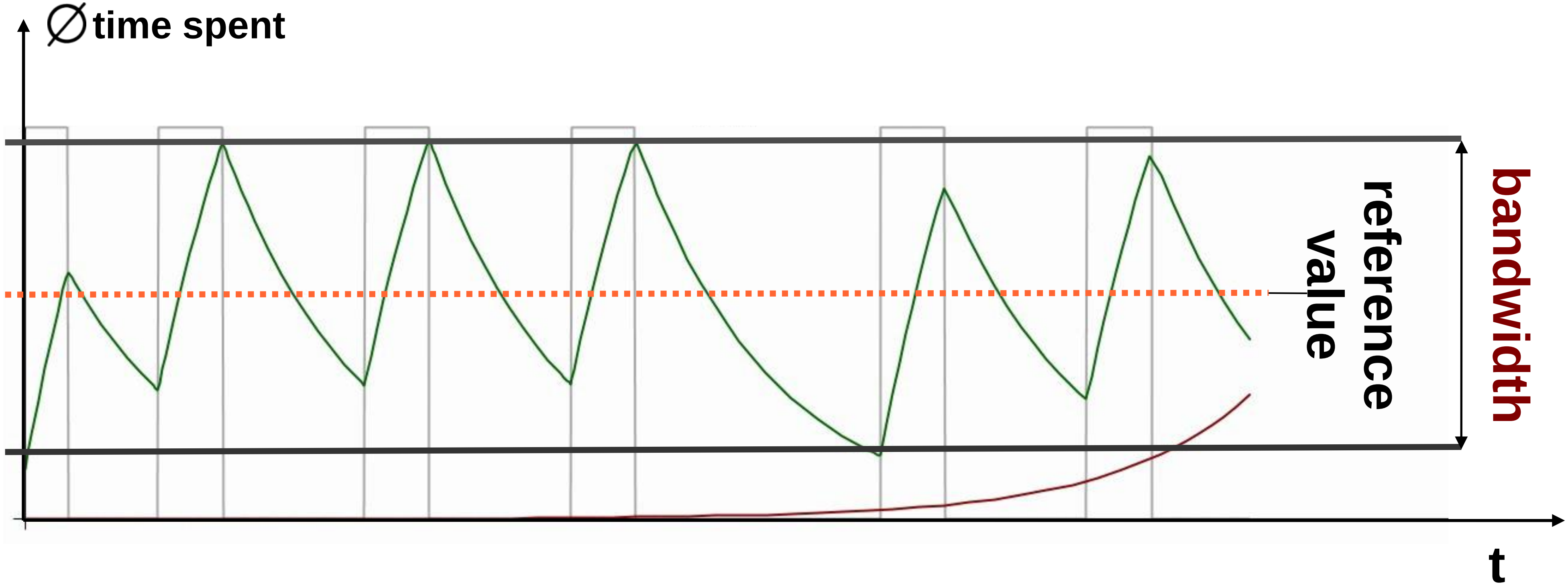

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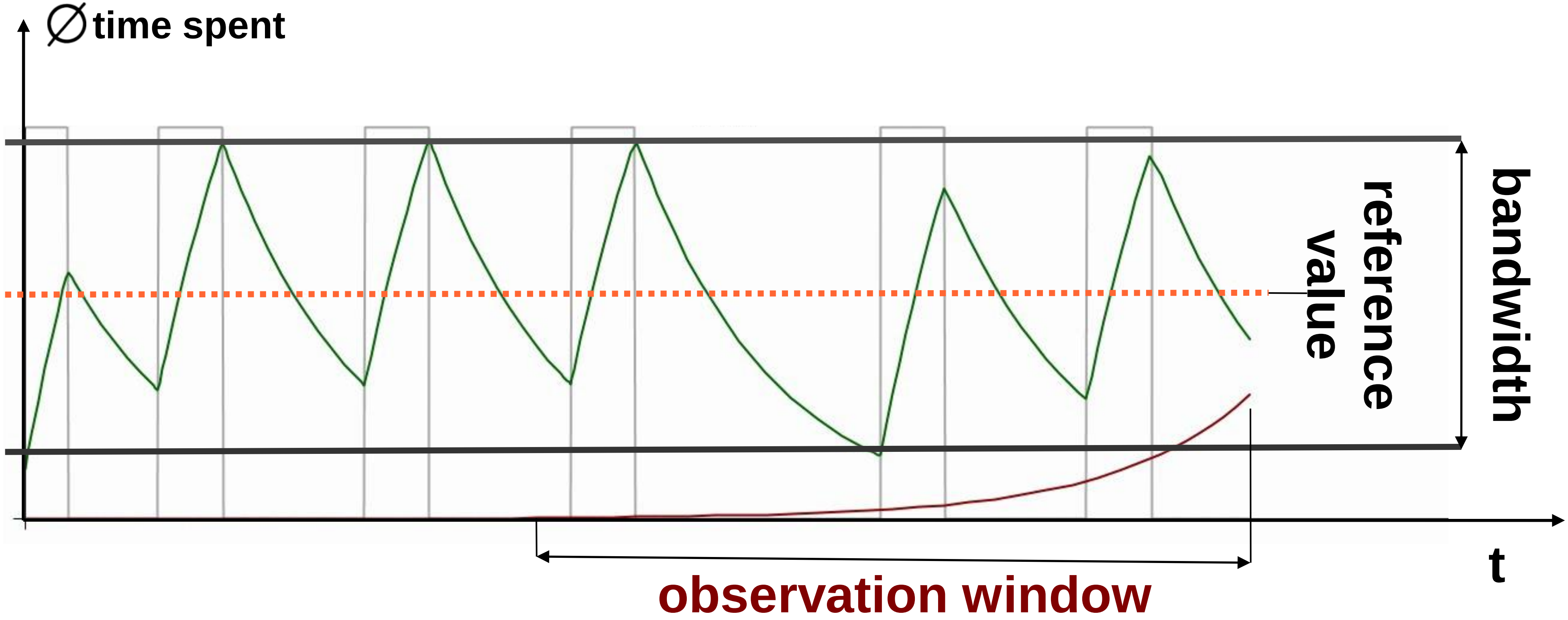

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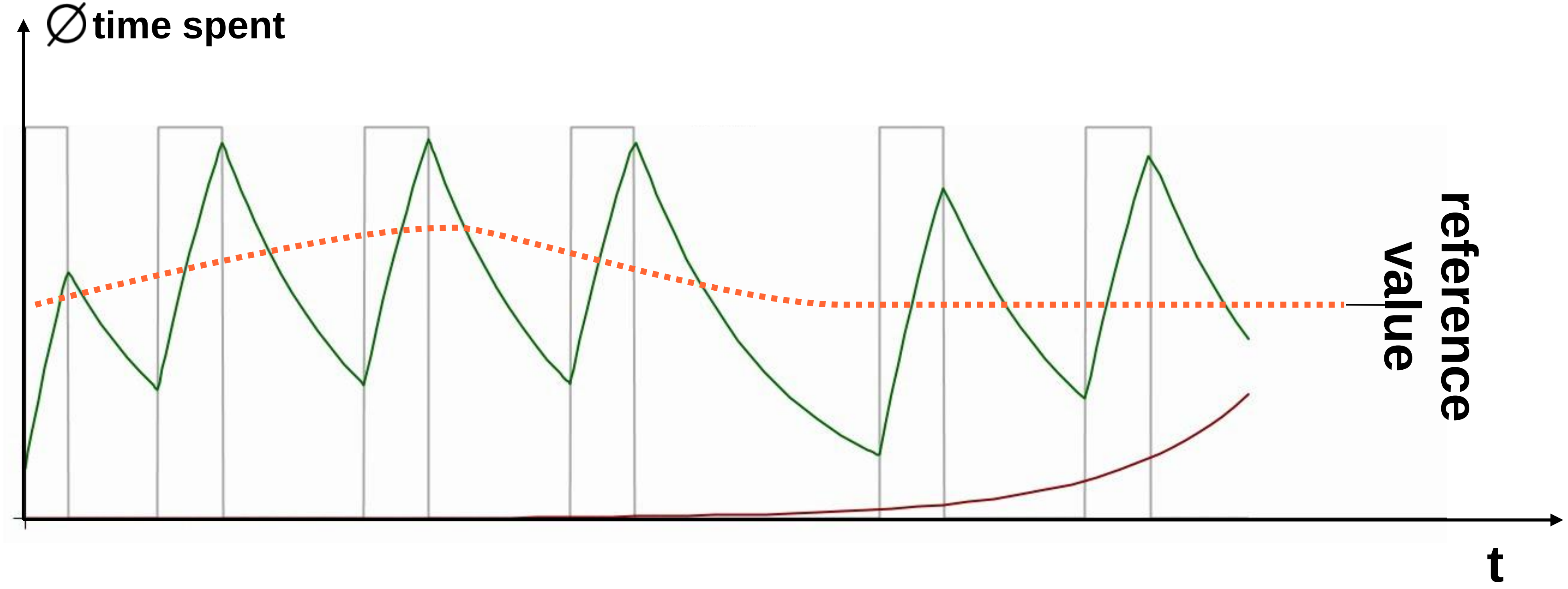
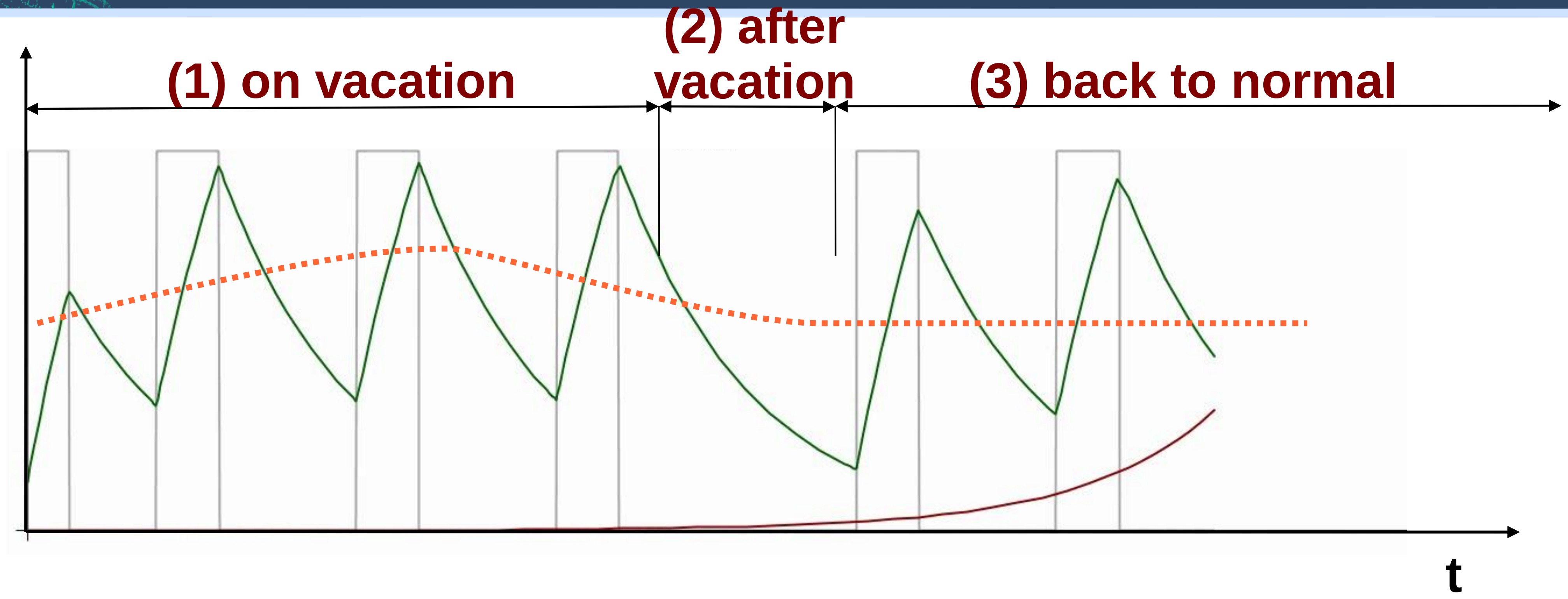
Projects



Project vacation



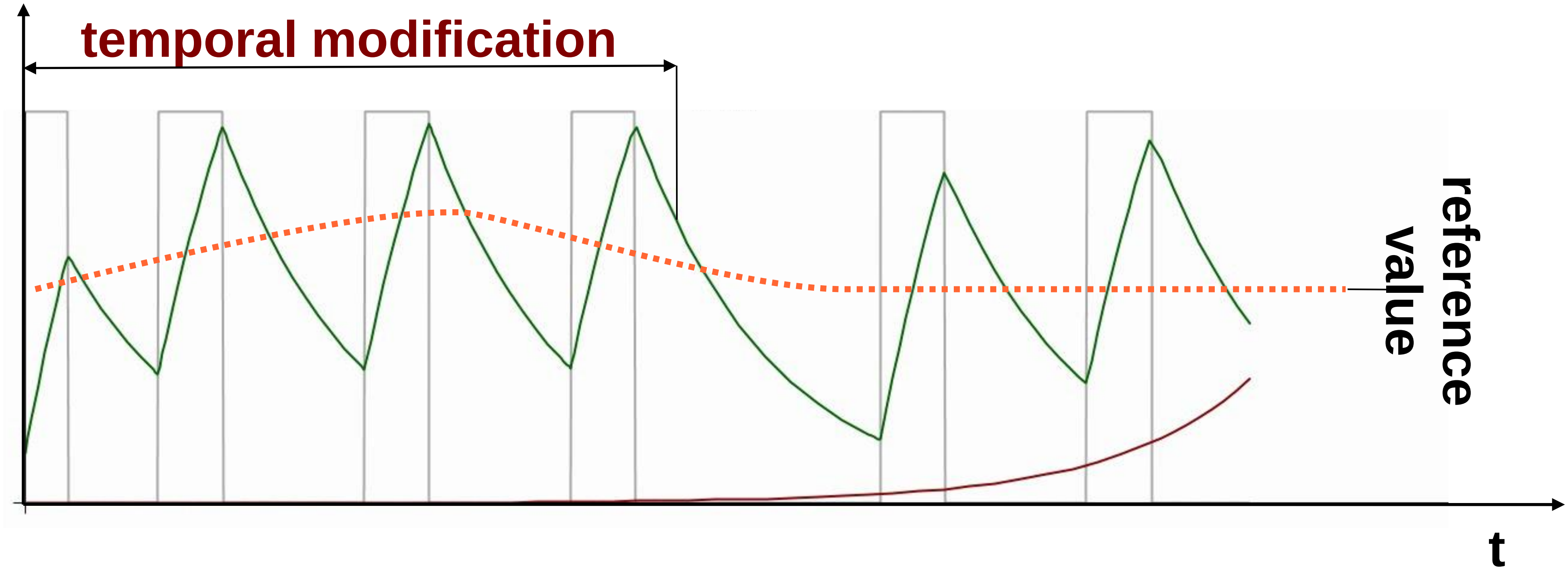
"play tennis" behavior of a person (influenced by project "vacation")

(1) is on vacation

(2) after vacation (work off what has been put aside)

(3) back to normal course of life

Project

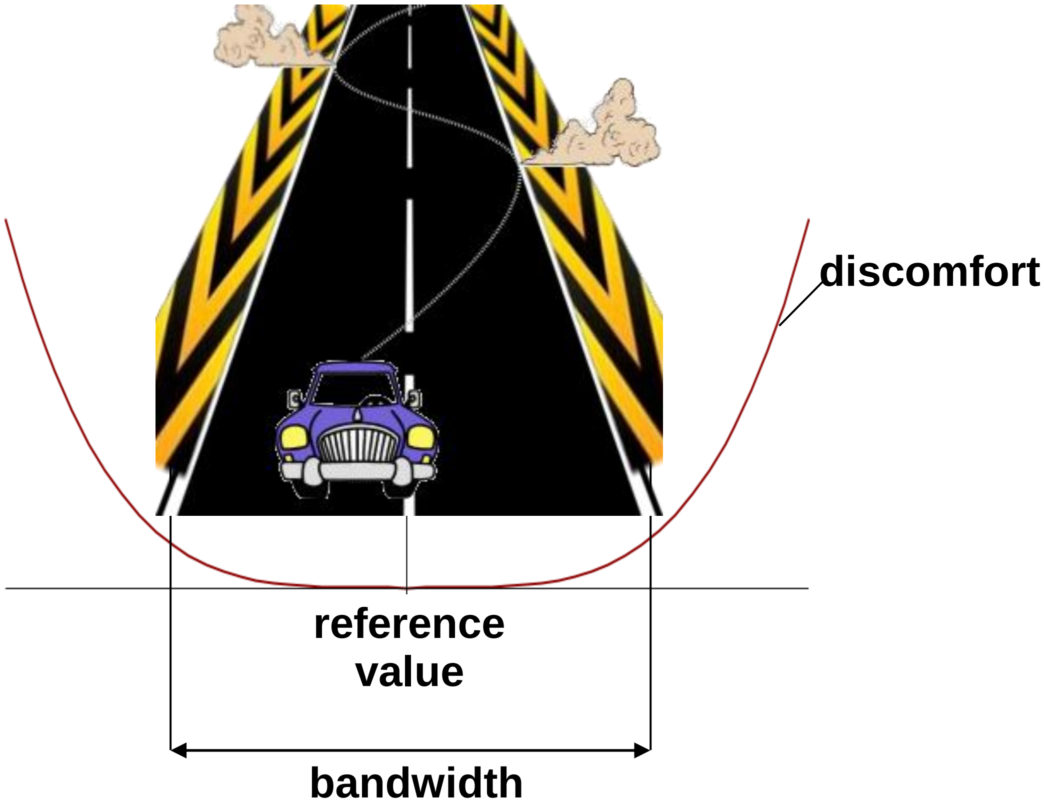


- Projects temporally modify reference values of targets

Heuristic (Discomfort)

Discomfort Measure

- Defines urgency an agent experiences to change its current situation



Heuristic (Discomfort)

Discomfort Measure

- Defines urgency an agent experiences to change its current situation

$$D(t) = \sum_{k=1}^{n} (f^k_{refVal}(t) - f^k_{monVal}(t))^2 \cdot \begin{cases} w^k_1 & \text{if } f_{monVal}(t)_k \leq f_{refVal}(t)_k \\ w^k_2 & \text{otherwise} \end{cases}$$

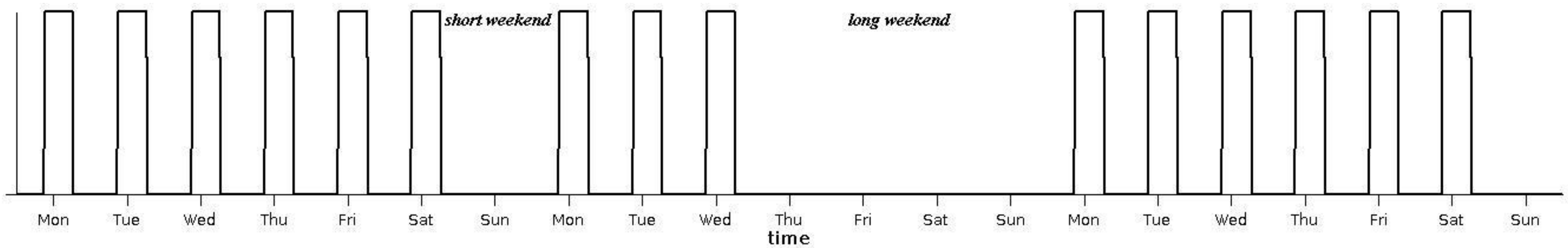
$$w^k_1 = \frac{1}{(f^k_{refVal}(t) - f^k_{lower-bandwidth}(t))^2}$$

$$w^k_2 = \frac{1}{(f^k_{refVal}(t) - f^k_{upper-bandwidth}(t))^2}$$

Effectiveness

Effectiveness of an activity execution at a specific time

- Shop **opening hours** for a **shopping** activity
- **Daylight intensity** for a **sleep** activity
- **Business hours** for a **work** activity



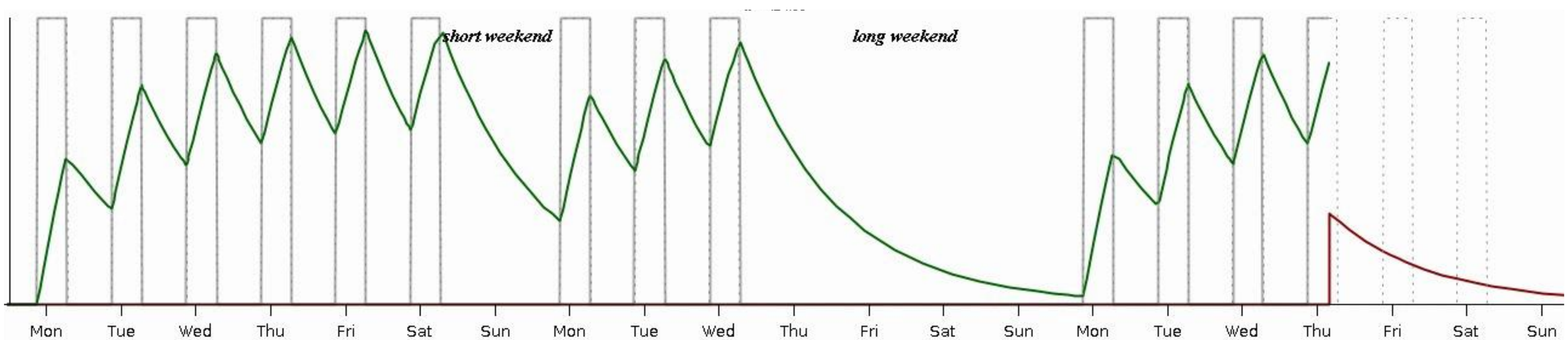
example of shop opening hours

Heuristic (Look-Ahead)

Look-Ahead Measure

- Indication about future opportunities

$$LA(t) = \begin{cases} 1 + w_1 \cdot \left(1 - \int_0^h (f_{effect}(t+x) \cdot kernel(x))\,\mathrm{d}x\right) & \text{if } f_{effect}(t) > u \\ 1 & \text{otherwise} \end{cases}$$



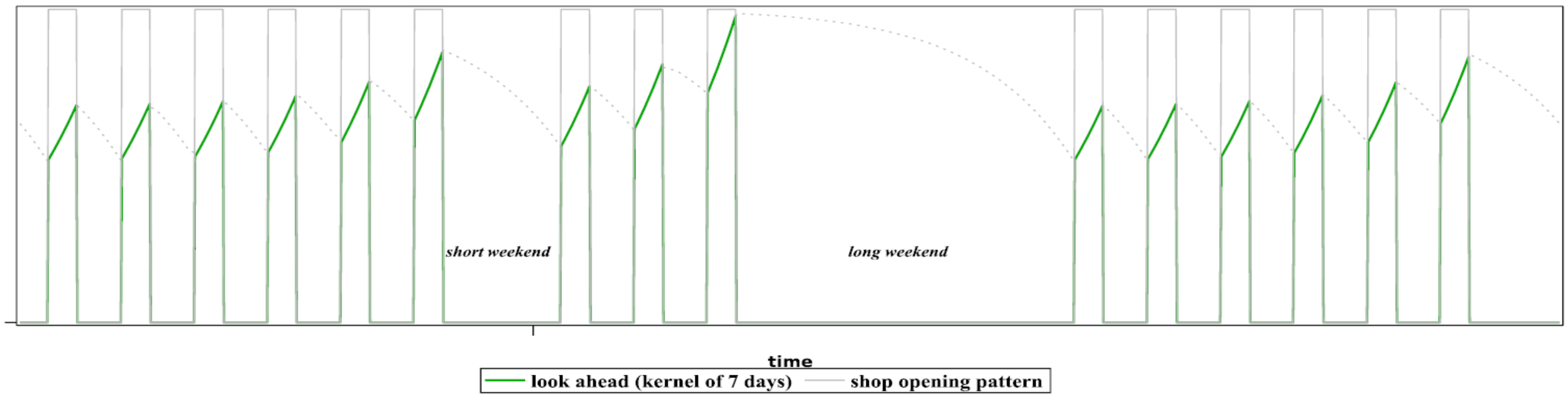
look-ahead measure through convolution with an exponential kernel

Heuristic (Look-Ahead)

Look-Ahead Measure

➔ Indication about future opportunities

$$LA(t) = \begin{cases} 1 + w_1 \cdot \left(1 - \int_0^h (f_{effect}(t+x) \cdot kernel(x))\,\mathrm{d}x\right) & \text{if } f_{effect}(t) > u \\ 1 & \text{otherwise} \end{cases}$$



Decision Heuristic

- considers activities which can be executed (or are executed based on cultural/social norms)
- considers activities which give more discomfort reduction per spent time
- simplistic location choice procedure
- favors activities which have fewer execution options in the future

Conclusion & Outlook

- Agents *behave* as expected *artificial* examples
- Rework code (performance / parallel framework)

- More simulation runs for validation using a 6 week travel diary (similar to Mobidrive)
- Location choice

Q&A

?