An assistive handwashing system with emotional intelligence

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Supervisor:
Jesse Hoey

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Overview

Problem Statement - Motivation

The COACH system

- is an assistive system helping with an elder's daily activities
- monitors a user washing his/her hands
- detects when the user has lost track of what he/she is doing
- displays a prerecorded assistive prompt when needed
- works well for some persons, but not as well for others

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- study of human emotions
- computationally modelling affective HCIs

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- is able to tune the prompts in some way according to the emotional state of a user

Note: The last objective is ill-defined, as the question of how exactly tuning prompts to users will be most effective is not clear at this point.

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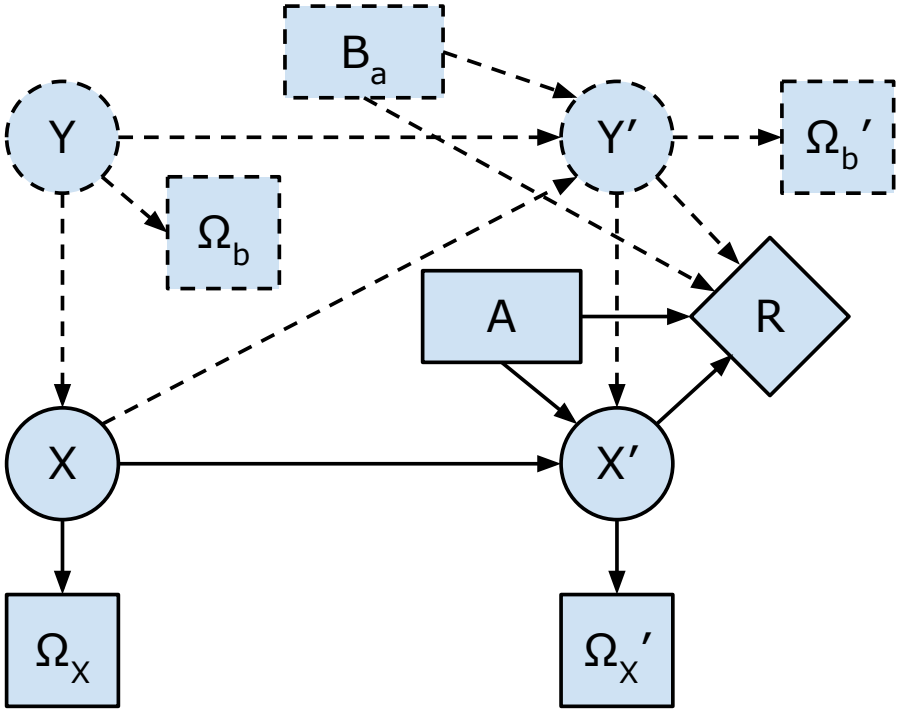
- describes social events by an Actor-Behaviour-Object (ABO) grammar
- "fundamentals" of identities and behaviours; shared between people within a same culture
- "transient impressions": emotional feelings of people evoked by a specific event

The ACT Principal

Actors work to experience transient impressions that are consistent with their fundamental sentiments.

Concepts - POMDP

Partially Observable Markov Decision Process (POMDP)



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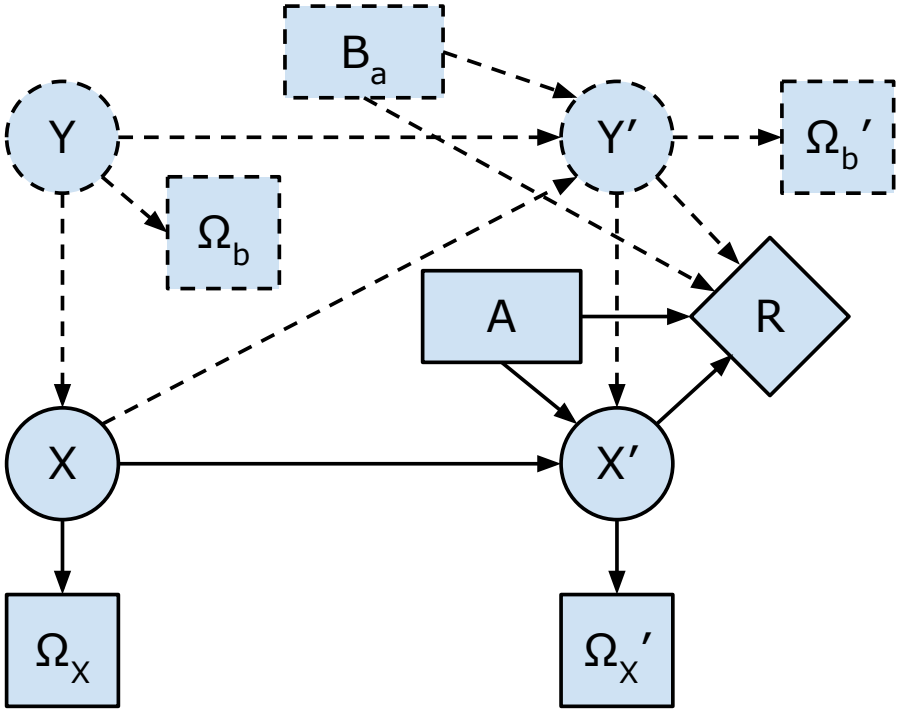

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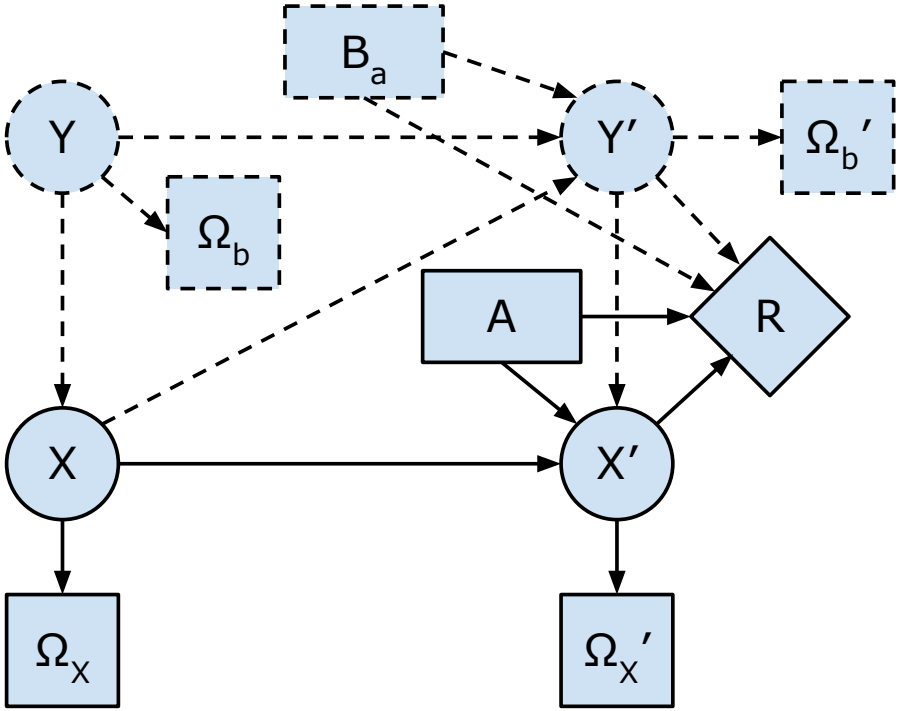

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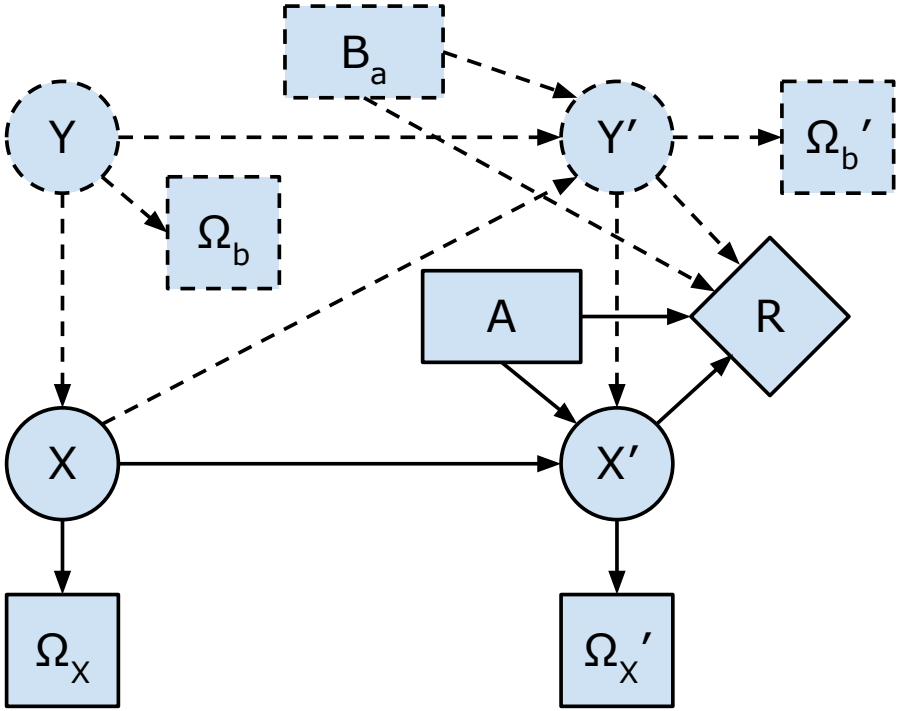

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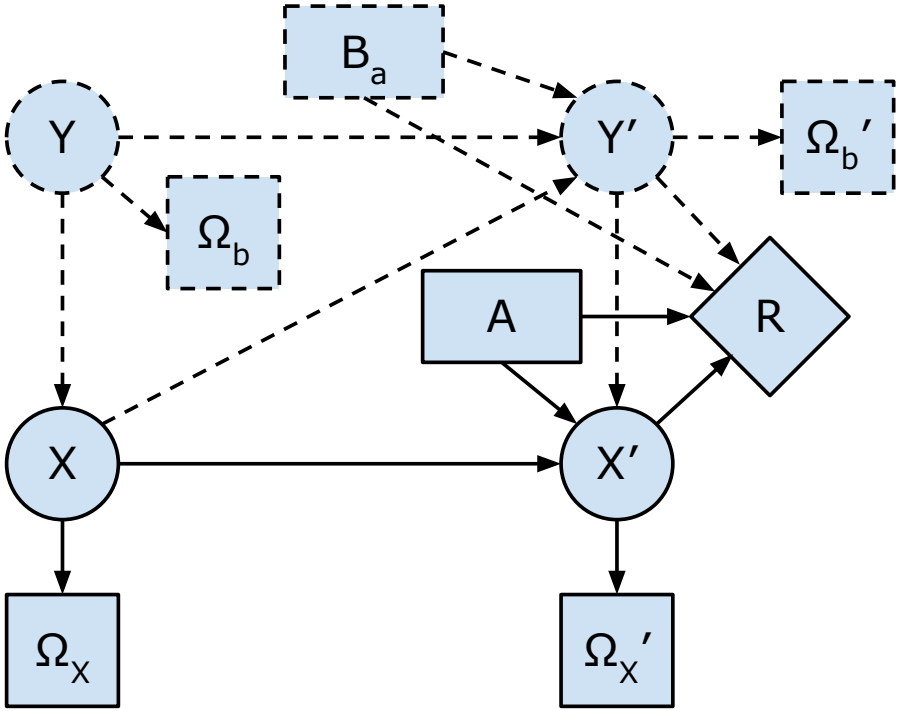

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- Augmented with affective states (dotted lines)

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- Combines the ACT with POMDP model so that can learn an interactant's identity

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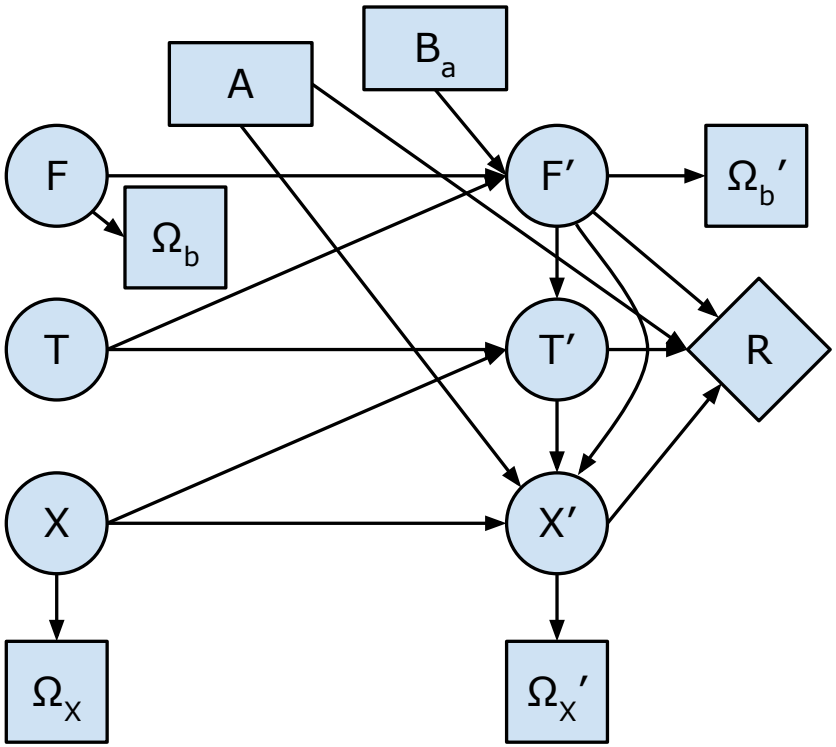

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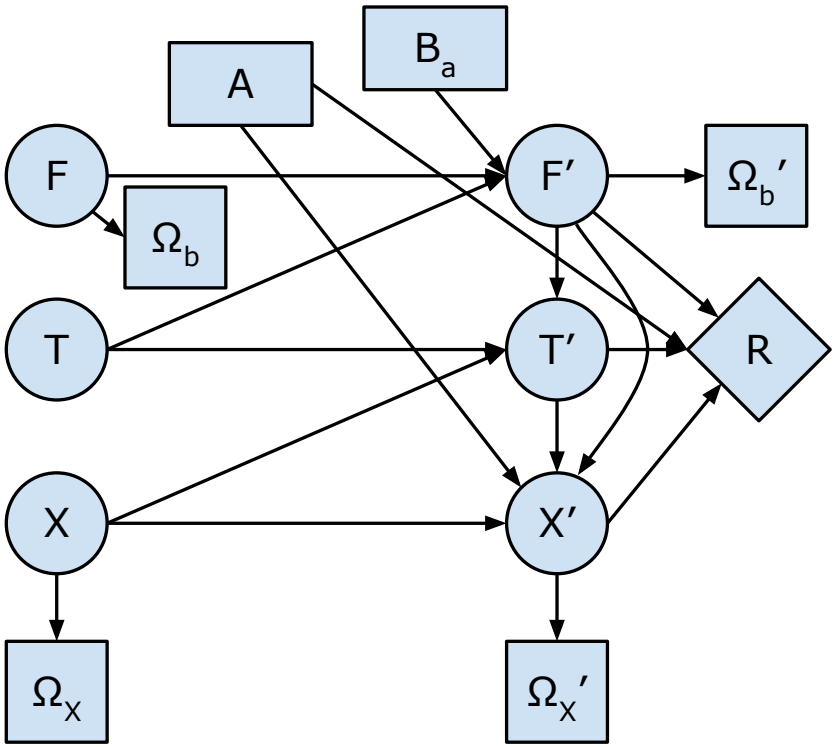

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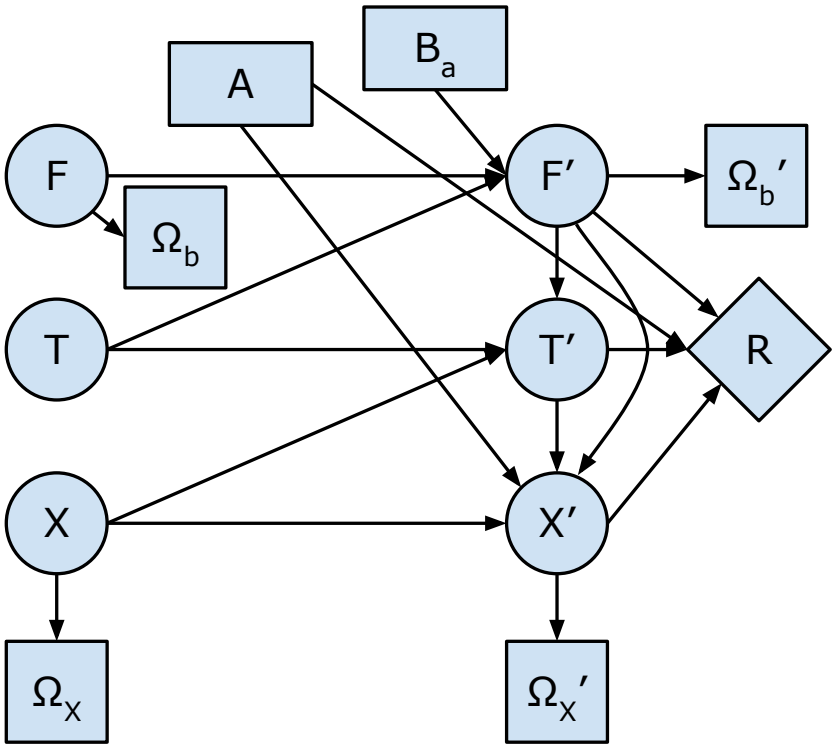

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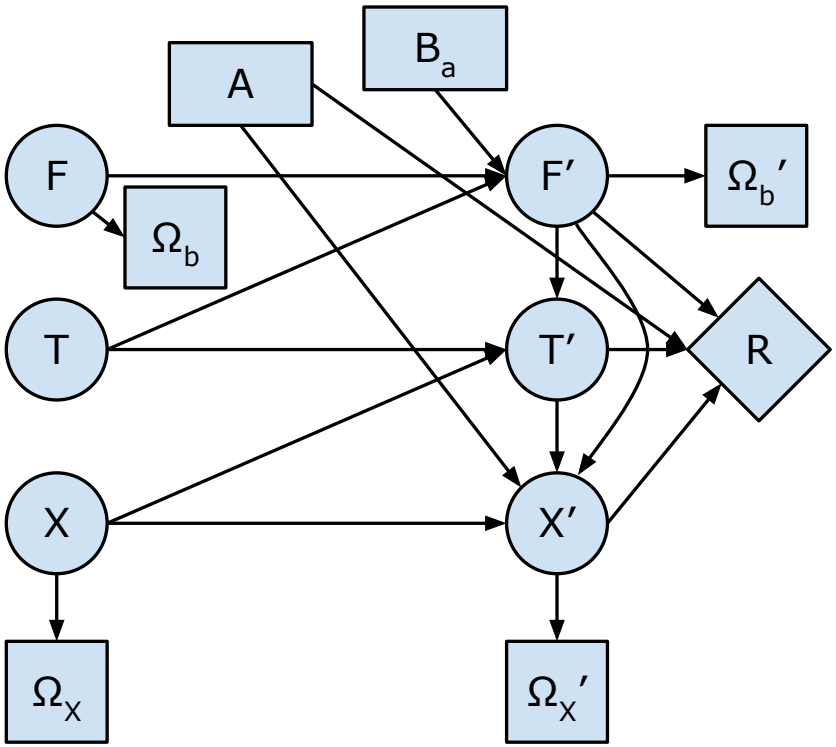

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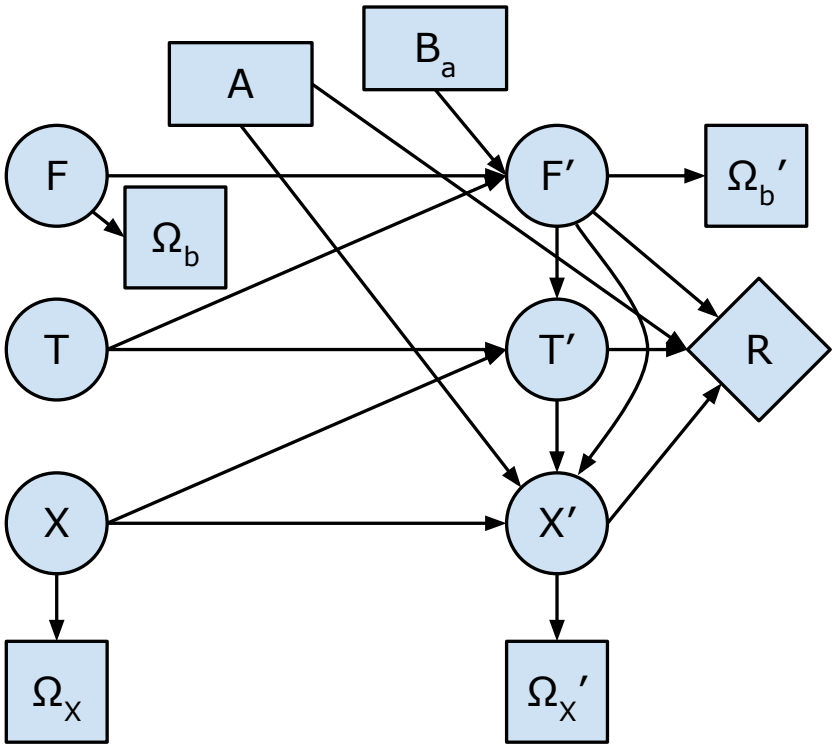

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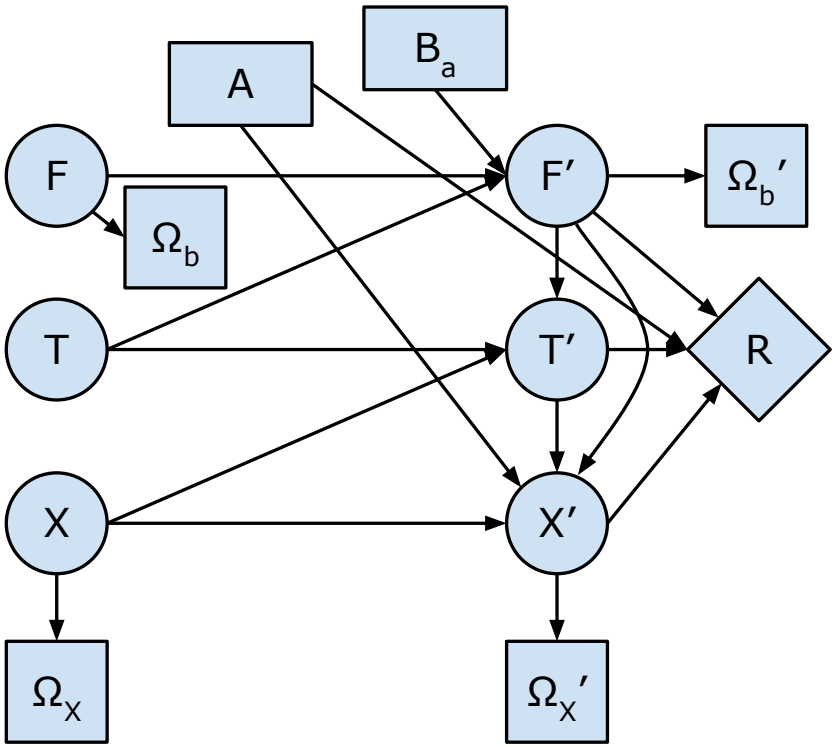

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- Observations $\Omega = \{\Omega_X, \Omega_b\}$
- Actions $\{A, B_a\}$
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- Calculate $\{A, B_a\}$ basing on $\{F, T, X\}$

Concepts - BayesACT cont.

Updates F and Calculates $\{A, B_a\}$ basing on $\{F, T, X\}$

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$$Pr(f'|f, t, x, b_a, \phi) \propto e^{-\phi(f',t')-\xi(f',f,b_a,x)} \tag{2}$$

where t' can be computed from $\{f', t, x\}$ by empirically derived prediction equations of ACT.

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- $Pr(x'|x, f', t', a)$: how the application progresses
- $Pr(\omega_b|f)$ and $Pr(\omega_x|x)$: observation functions for the client behaviour sentiment and system state

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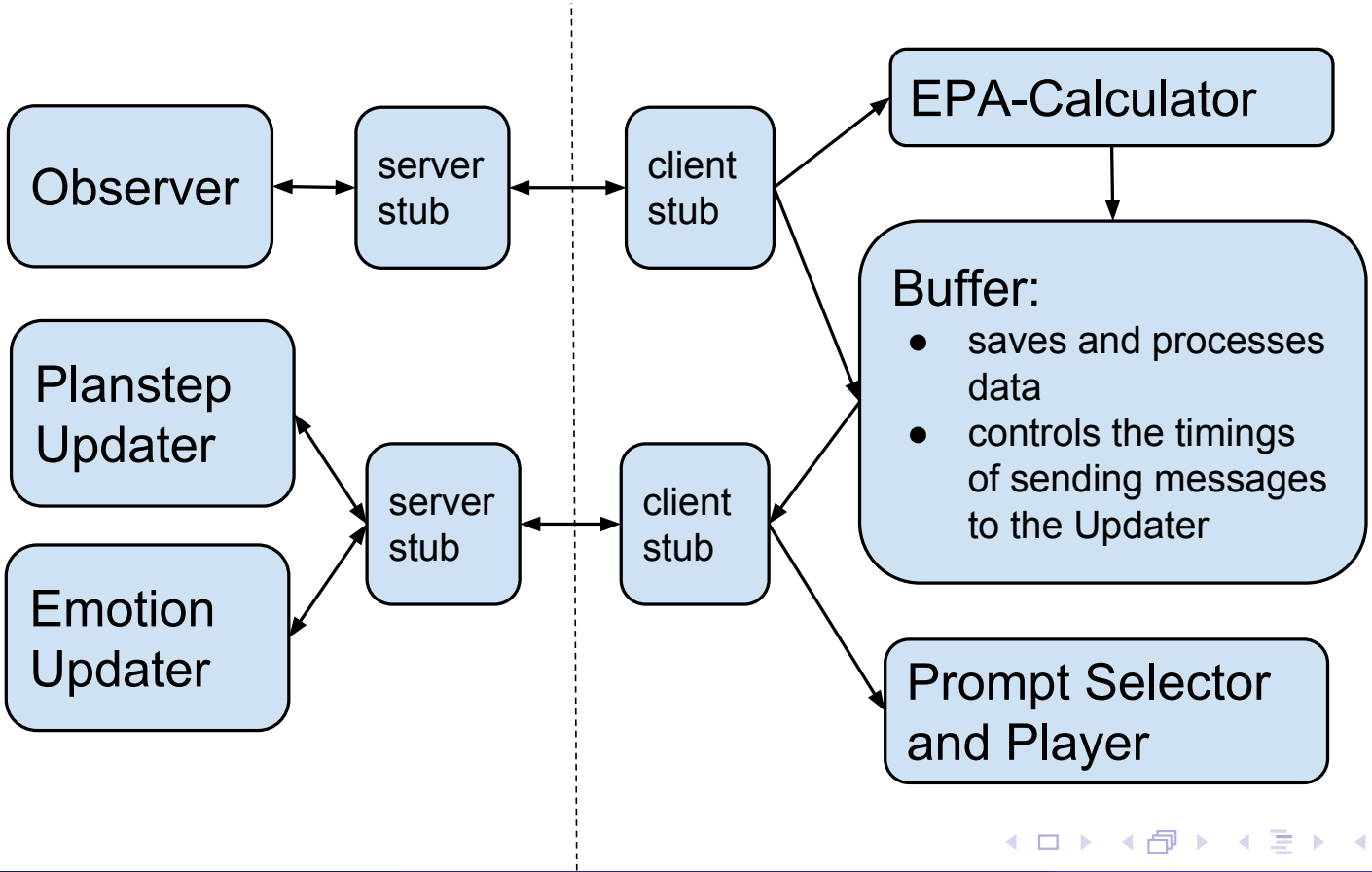
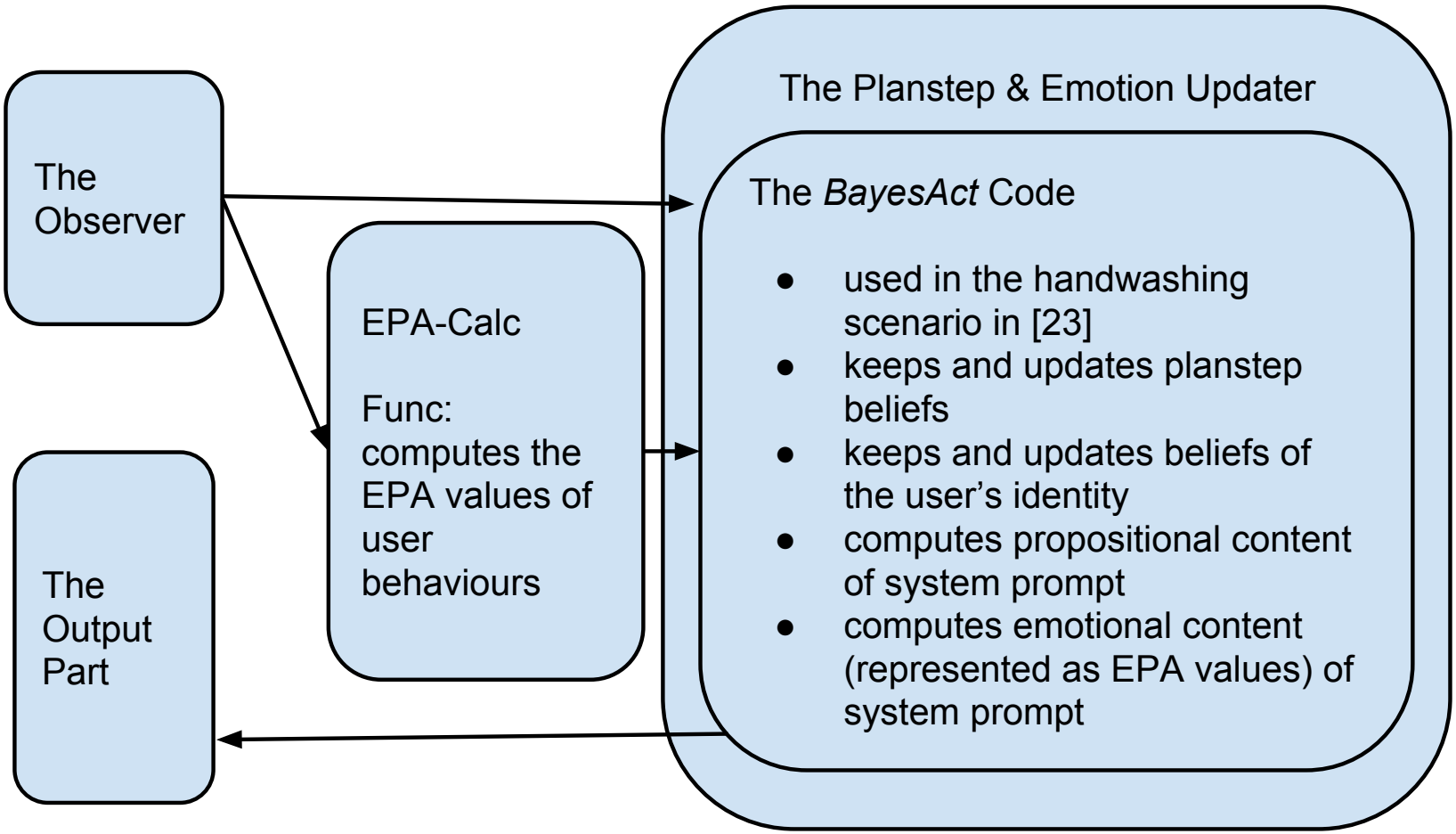


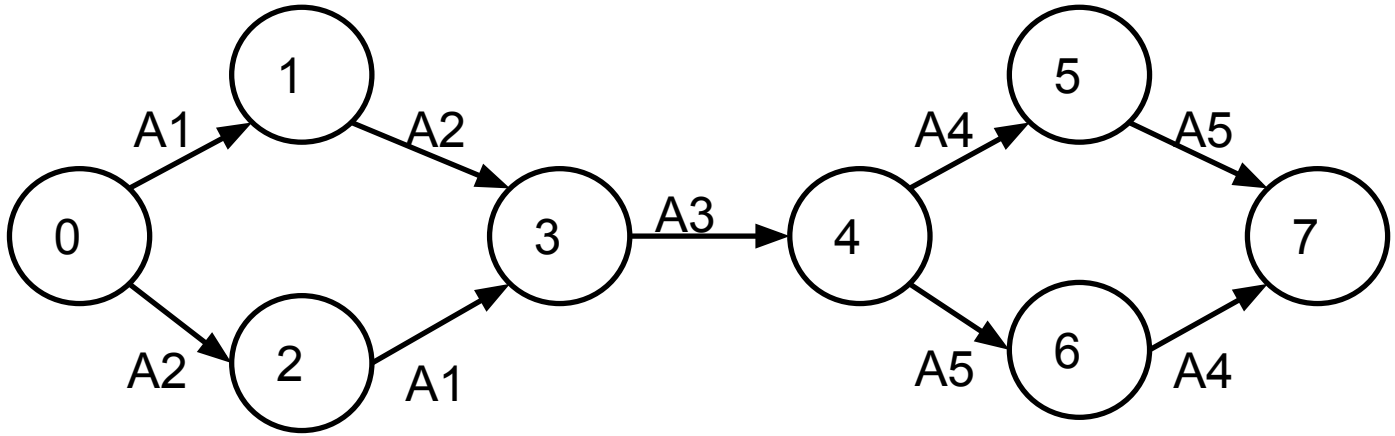
Solution - the Planstep and Emotion Updater

Design the Planstep and Emotion Updaters basing on the BayesAct code



Solution - the Planstep and Emotion Updater cont.

A planstep update diagram



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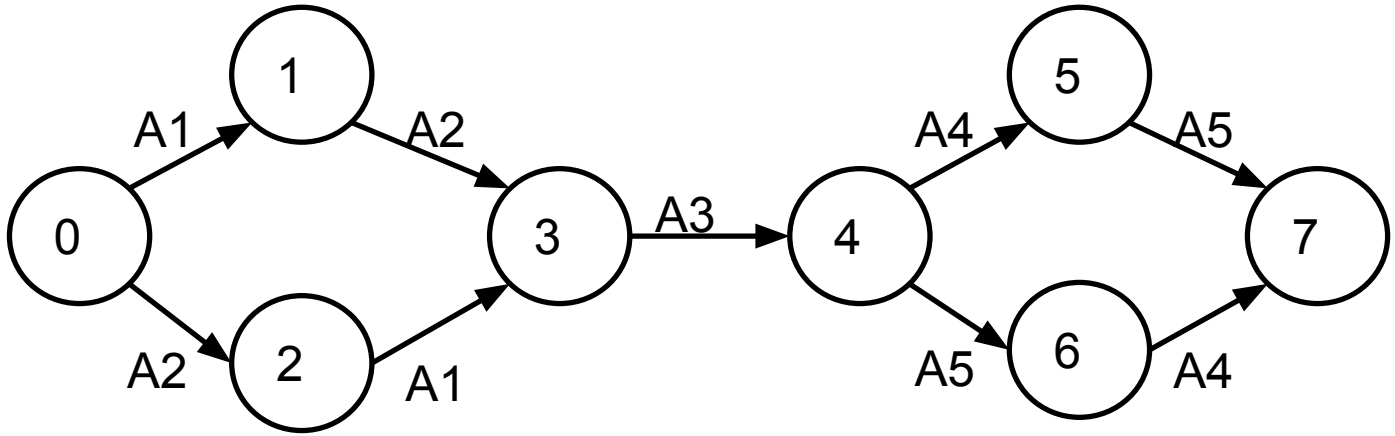

- Eight plansteps: (0) "off/dirty/dry", (1) "on/dirty/dry", (2) "off/soapy/dry", (3) "on/soapy/dry", (4) "on/clean/wet", (5) "off/clean/wet", (6) "on/clean/dry", (7) "off/clean/dry"

Solution - the Planstep and Emotion Updater cont.

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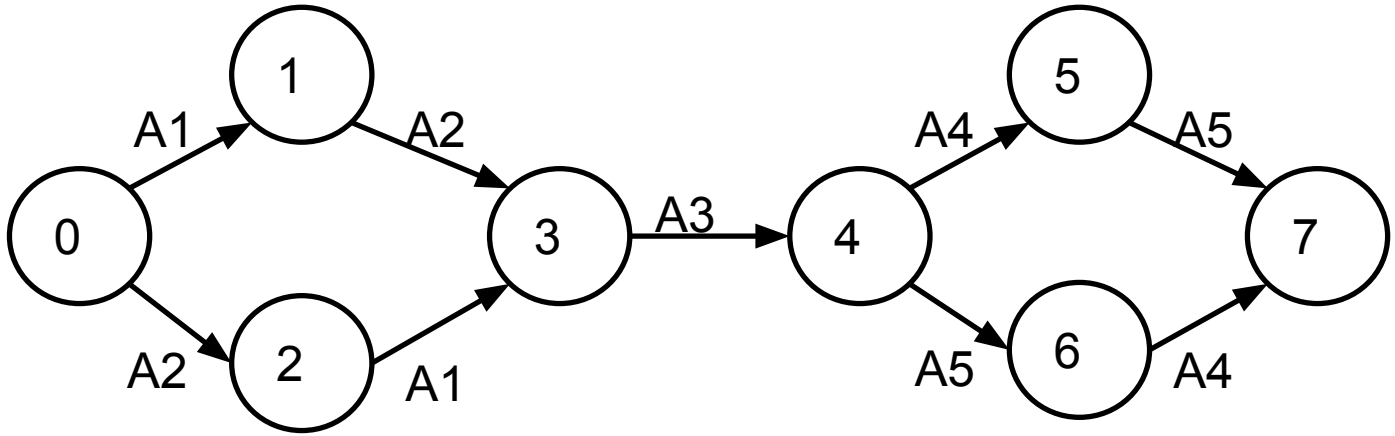

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- Five behaviours: A1 to A5 are "turn on water", "put on soap", "rinse hands", "turn off water", and "use towel", respectively.

Solution - the Planstep and Emotion Updater cont.

Use the BayesACT framework in the handwashing scenario

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- A denotes the propositional content of a system message; B_a denotes how the message should be expressed

Solution - the EPA-Calculator

Solution - the Observer

Solution - the Output Part

Solution - the Buffer

Experiments - Variables and Parameters

Experiments - Variables and Parameters cont.

Experiments - Test #1

Experiments - Test #1 cont.

Experiments - Test #2

Experiments - Test #2 cont.

Experiments - Conclusion

Discussion - Contribution

Discussion - Future Work

References

[1] The bayesact paper
[2] The tracker paper.
[3] The survey paper.

Acknowledgement

Jesse Hoey
James Tung and Peter van Beek
Xiao Yang, Chengbo Li and Enxun Wei

The end

Thank you!

- Questions?
- Comments?