**Supporting Mental Model Accuracy in Trigger-Action Programming**

**Analysis notes**

* **What problem are the authors trying to solve?**

The authors studied inconsistencies in interpreting the behavior of trigger action programs and errors made in creating programs with desired behavior.

* **Examples of trigger-action pairs**

1. *If* everyday at 12:00 PM, *then* send me an email at [xyz@gmail.com](mailto:xyz@gmail.com)
2. *If* sleep duration below 7.5 hours*, then* turn on your coffee maker
3. *If* you exit an area, *then* turn off lights.

* **Mental Model Ambiguity explanation with examples**

There are ambiguities in interpretation of when triggers occur, whether the conjunction of two triggers is meaningful to people, and whether sustained actions will revert automatically.

E.g.1 If I am sleeping, then turn stereo off

*Ambiguity –* Turn off when I fall asleep or anytime I’m sleeping?

E.g.2 If the doorbell rings and the sun is setting

*Ambiguity –* Conjunction may never occur.

* **Study 1: Program Interpretation**
  + **Purpose –** To begin understanding how users interpret different trigger and action types.
  + **Number of participants –** 60
  + **Method –** Ask users
    1. when an action would occur given single or multiple triggers
    2. when an action would end given a fully specified rule
    3. open ended questions to understand interpretation of the differences between different kinds of triggers.
  + **Results** –
    1. Expectations about triggers depend on the specific trigger(s)
    2. Multiple event triggers are considered to be technically valid although probability of occurrence is infinitesimal
    3. Expectations varied widely for multiple state triggers
    4. When sustained actions end depends on the trigger
* **Study 2: Program Creation**
  + **Purpose –** To investigate whether program creation by the users themselves mitigates the ambiguities observed in the first study.
  + **Number of participants –** 42
  + **Method –** Designed a TAP interface to feature multiple triggers with different trigger and action types. The interface borrowed visual aspects of IFTTT, as well as the workflow for creating rules. Then users were presented with 5 program creation questions followed by 5 multiple choice questions about the participant’s interpretation of a given rule.
  + **Results –**
    1. Multiple event triggers were used in practice.
    2. Event and state triggers were hard to reason about.
    3. Users had varied mental models for state triggers.
    4. Users disagreed on sustained actions and forgot to undo them.
    5. User interpretations may be influenced by existing products.