# T-SWARM: A method for eliciting user trust requirements

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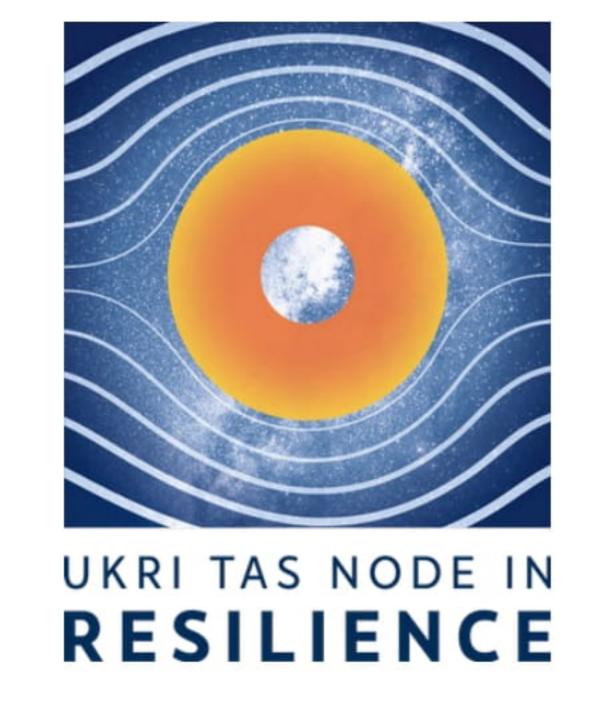
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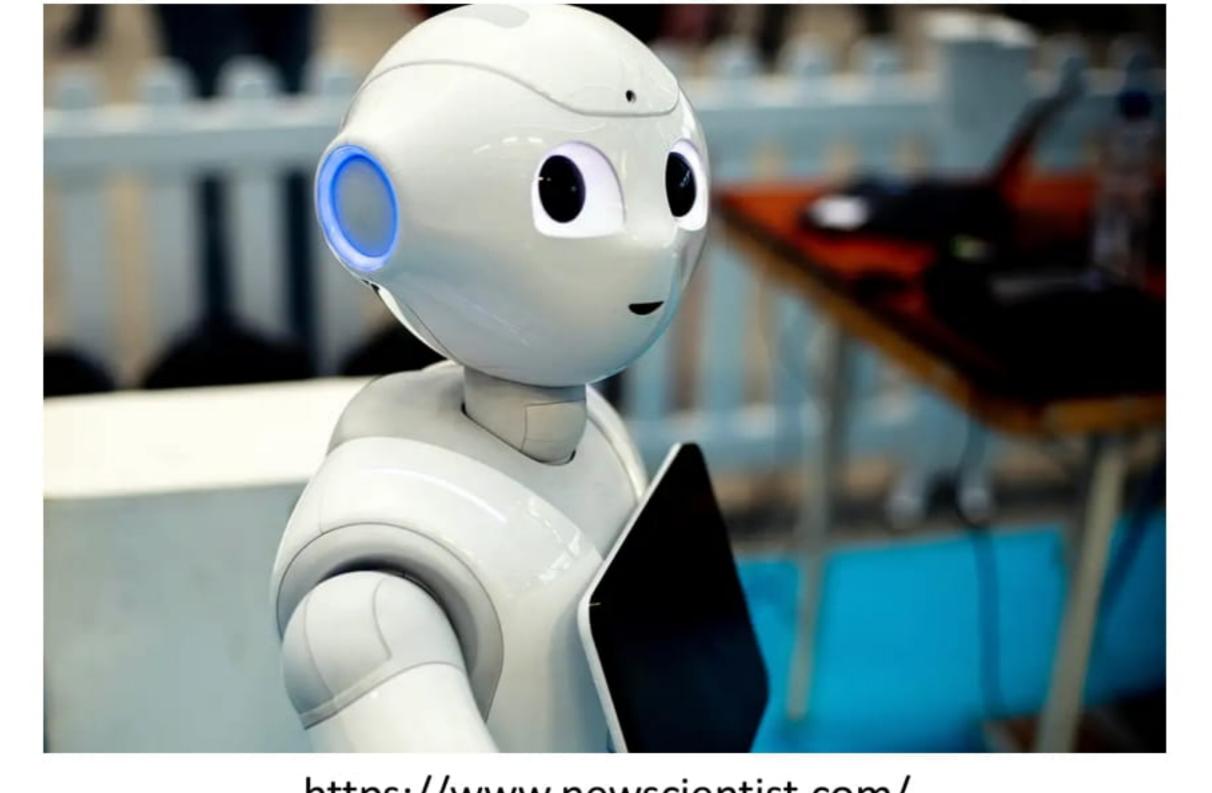
## 1. Trustworthy Autonomous Systems of the future

## How can we trust future autonomous systems?

- Autonomous systems are becoming more prevalent and integrated within our daily lives. As the functionality and capabilities of automated technologies increase, the role that humans play within many systems will change.
- The Trustworthy Autonomous Systems (TAS) projects aims to understand how we can develop trustworthy autonomy.
- As Human Factors researcher we ask what is required of a system to enable the human user to trust it?











https://mindmatters.ai/2020/09/meet-the-u-s-armys-new-drone-swarms/

# 2. Designing Trustworthy Human-Machine Interactions with T-SWARM

We have developed a method for developing user centred design requirements for trustworthy autonomous systems that accounts for the interactional nature of system behaviour and the wider context it occurs within. This T-SWARM method extends the Perceptual model and develops a taxonomy for trustworthy systems.

## Perceptual Cycle Model + Trust

- The Perceptual Cycle Model (PCM; Neisser, 1976) represents how our schema (or cognitive model) for events influences our actions as well as how we attend to and obtain information from the world.
- Our work within the TAS program has been the first to apply trust to the PCM. Figure 1 presents an overview of the model, with its three main components, depicting how they capture trust.
   Table 1. Trust prompts in the Trust-Schema World Action Research Method (T-SWARM Parnell et al, 2022)

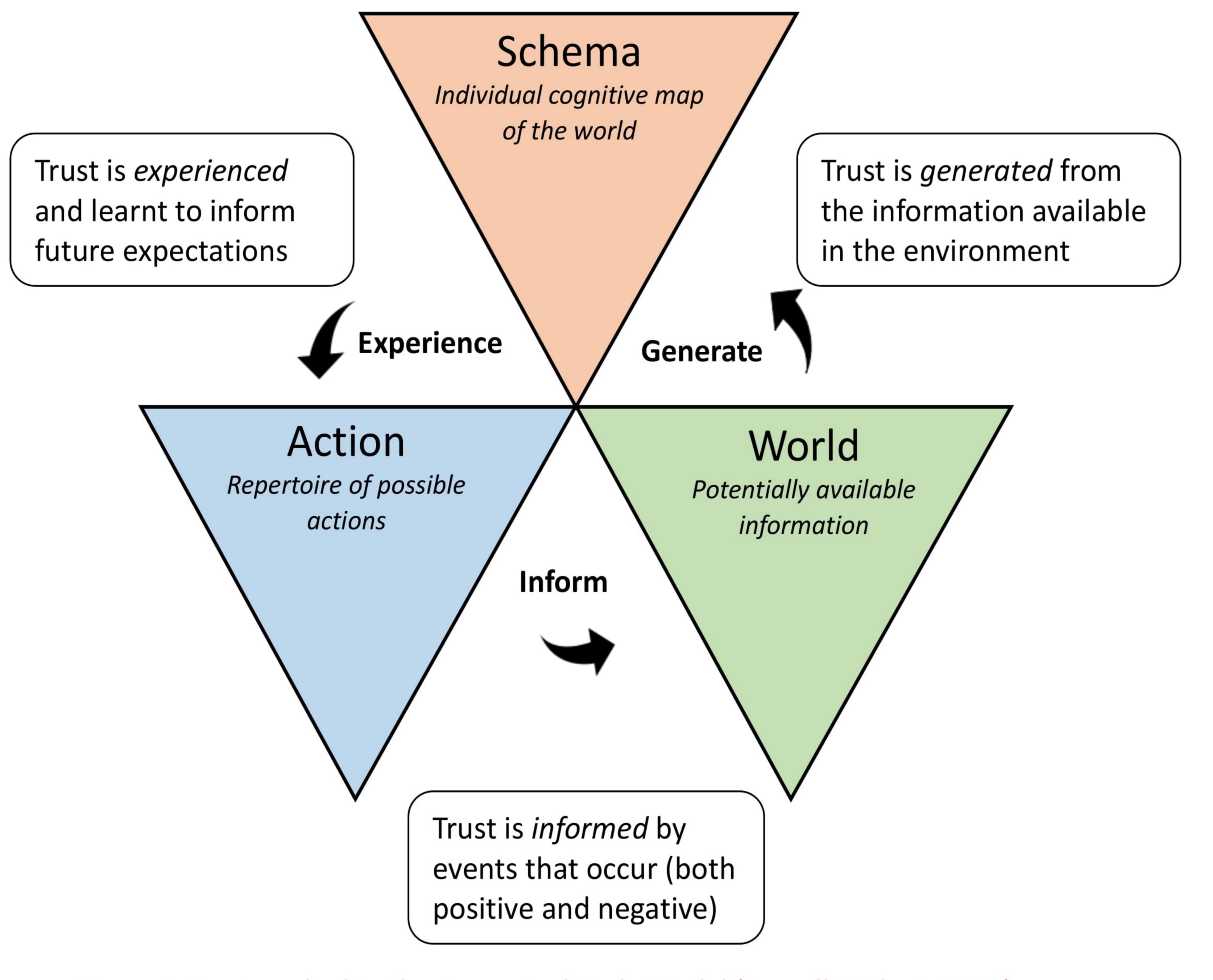


Figure 1. Trust applied to the Perceptual Cycle Model (Parnell & Plant, 2022)



Using the PCM framework we can use the methodologies that accompany it to capture, analyse and build trust. The SWARM (Plant & Stanton, 2016) is an interview method that provides:

- Interview prompts to capture the Schema, World, Action components
- A framework to thematically code and analyse interview responses
- Outputs that inform key design recommendations

T-SWARM builds on this by questioning trust across the Schema World Action pillars (see Table 1)

### References:

- Neisser, U. (1976). Cognition and reality. San Francisco, CA: W. H. Freeman and Company.
- Parnell, K.J., et al (2022) Trustworthy UAV relationships: Applying the Schema Action World taxonomy to UAVs and
- UAV swarm operations. International Journal of Human Computer Interaction (provisionally accepted)
  Plant, K. L., & Stanton, N. A. (2016). The development of the Schema World Action Research Method (SWARM) for the elicitation of perceptual cycle data. Theoretical Issues in Ergonomics Science, 17(4), 376–401.

#### **Trust Questions** SAW Schema Past experience Can you recall a point in this situation when you did not trust the technology? Current experience Would you generally tend to trust the technology? Do you have any distrust in the technology? Would you be wary or suspicious of the technology at all? Future expectations Would you have any reason not to trust to technology in the future? How reliable/dependable do you view the technology to be? What actions would you be relying on the technology for? Action What actions would you not be relying on a technology for? How easy would it be to trust the technology to do their job? How could your trust in the technology change over the course of the operation? Could there be any negative outcomes? And how would this effect your trust in the technology for the future? Would you ever be uncertain about the reliability or relevance of the World information that you had available to you? What information/knowledge would you need to trust the technology? Could there be any deceptive information? What information would you need to repair any lost trust in the technology?

Design requirements for these key factors can be generated in relation to four categories:

