

Designing Interfaces II

Prepared by:

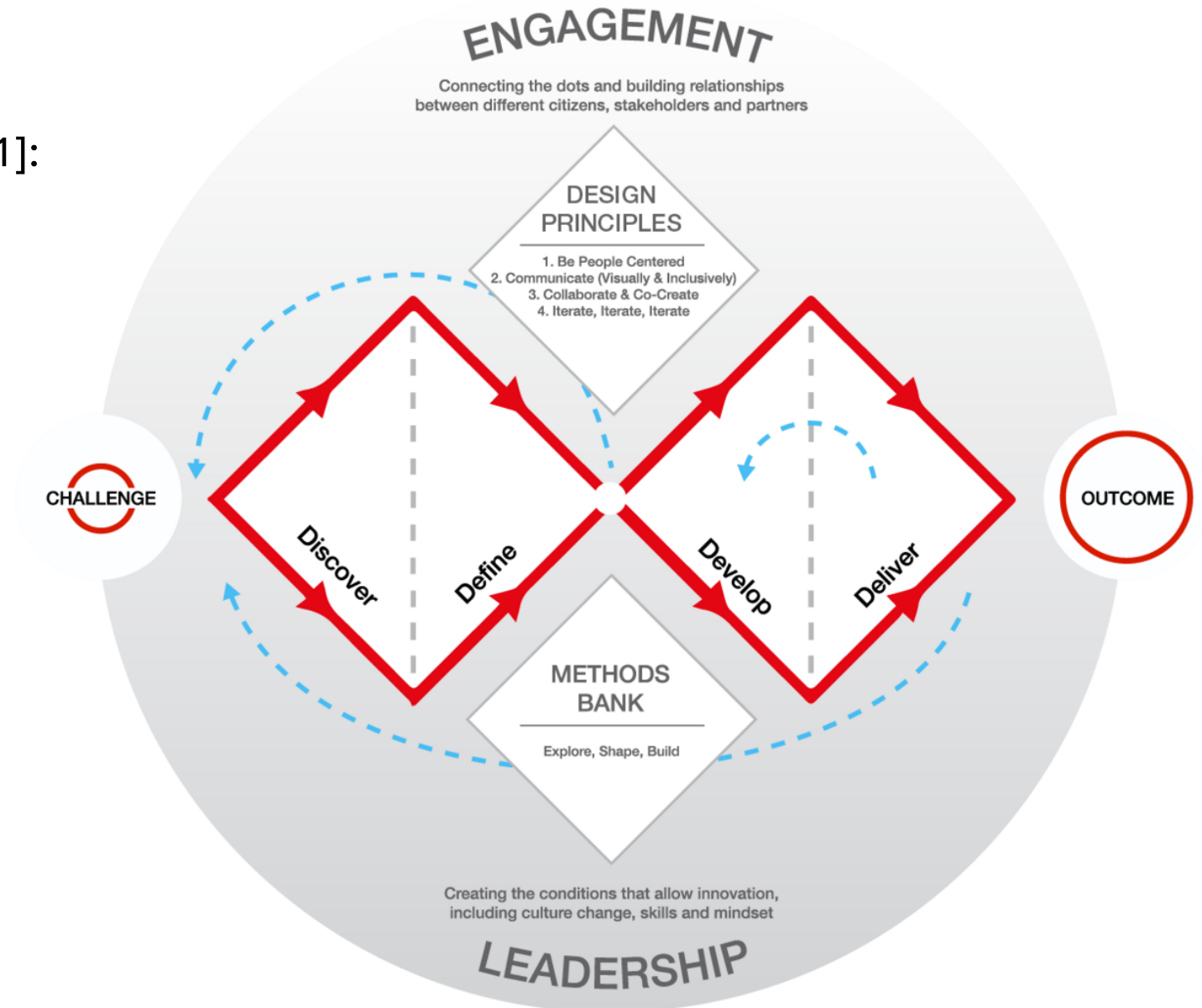
Dr. Fahad Ahmed

Topics of Discussion

- Designing for Usability
 - The Double Diamond approach
 - Activity Theory
- Tools for Designing Interfaces
 - Interactive Prototyping
 - Figma (creating an account as a UWTSD student)

Designing for Usability

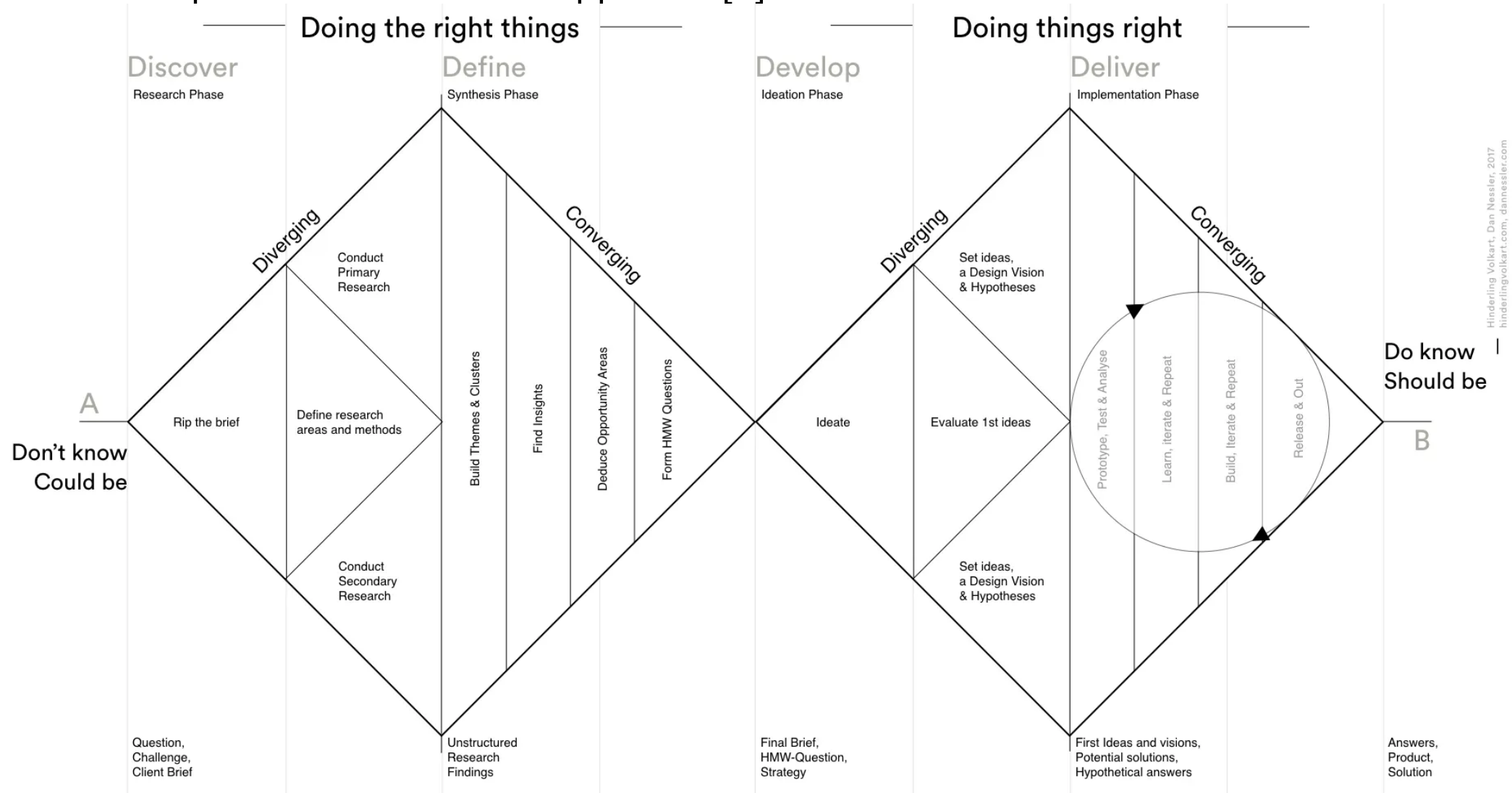
- The Double Diamond Approach [1]:



[1] <https://www.designcouncil.org.uk/resources/framework-for-innovation/>

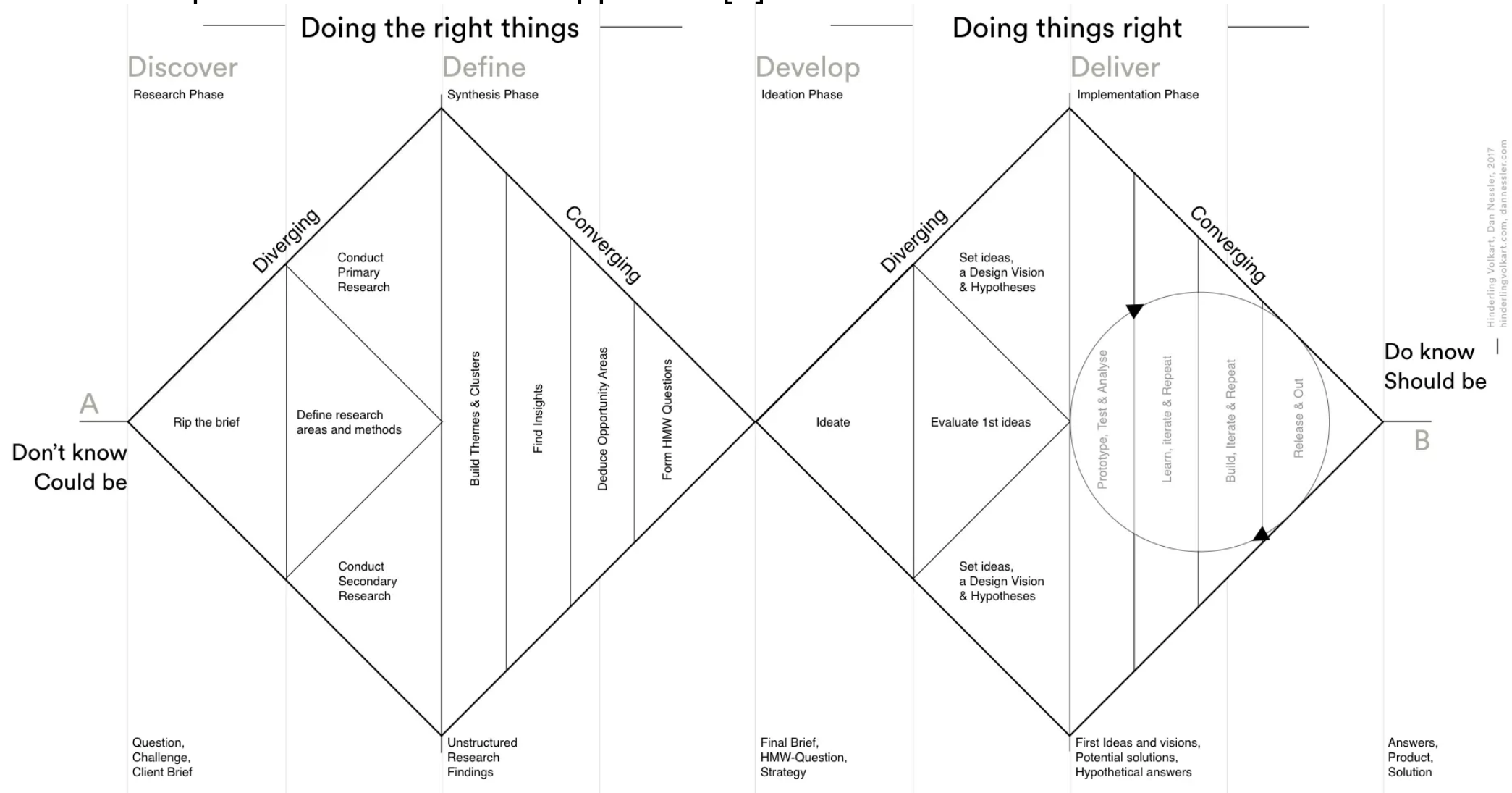
Designing for Usability

- The Revamped Double Diamond Approach [2]:



Designing for Usability

- The Revamped Double Diamond Approach [2]:



What is Activity Theory?



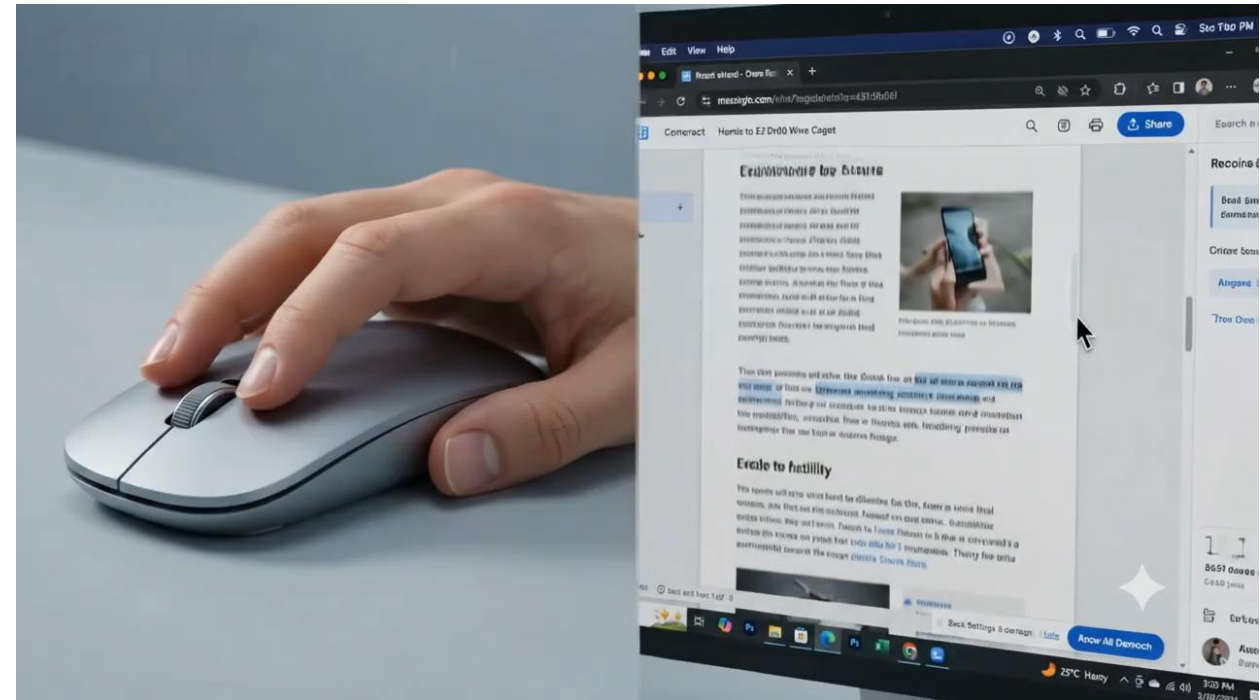
Adapted from the youtube video that can be found here: <https://www.youtube.com/watch?v=mb-3ufwK6U0>

Activities, Actions & Operations

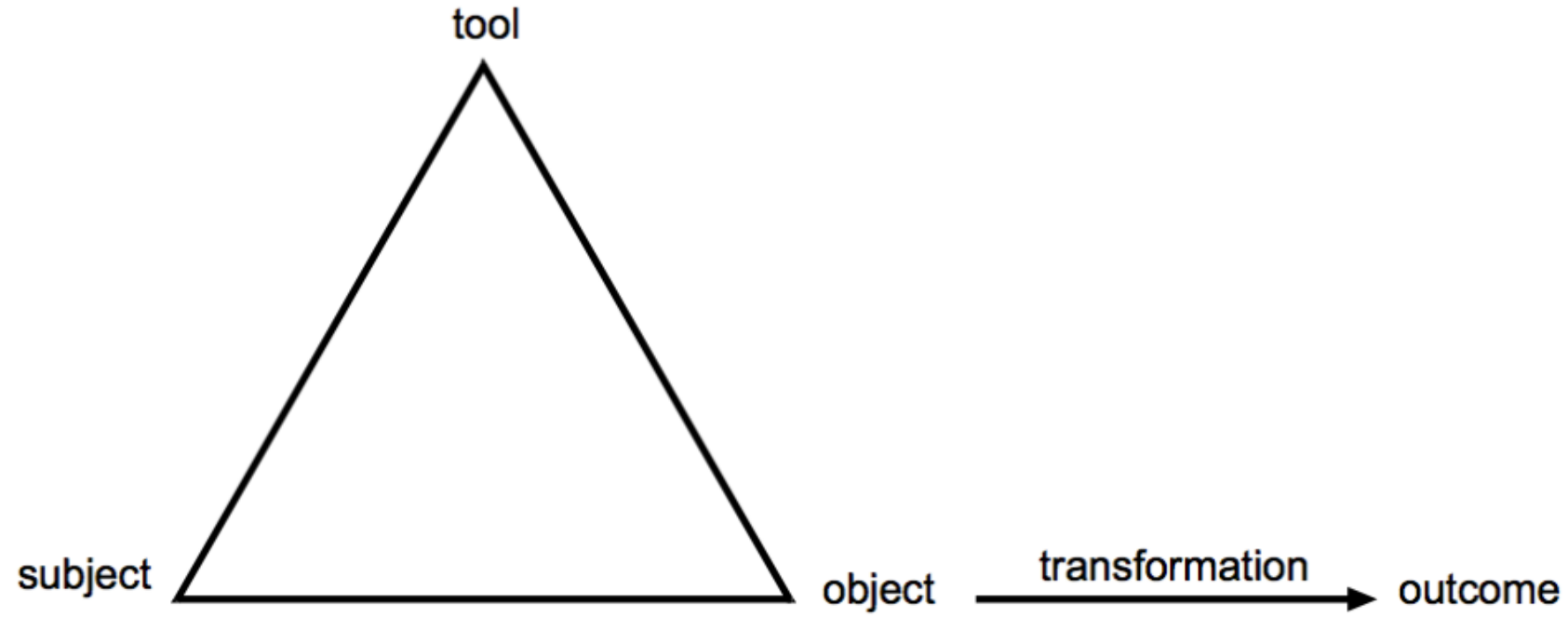
- *Activity* is the top level [3]
 - Driving a car, getting from A to B
- *Actions* are the discrete components [3]
 - Changing lanes, turning, overtaking
 - Achieve goals **consciously**
- *Operations* are the mechanical means [3]
 - Change gear, engage clutch, turn wheel
 - **Unconscious** but necessary
 - Situation-dependent

Activities, Actions & Operations

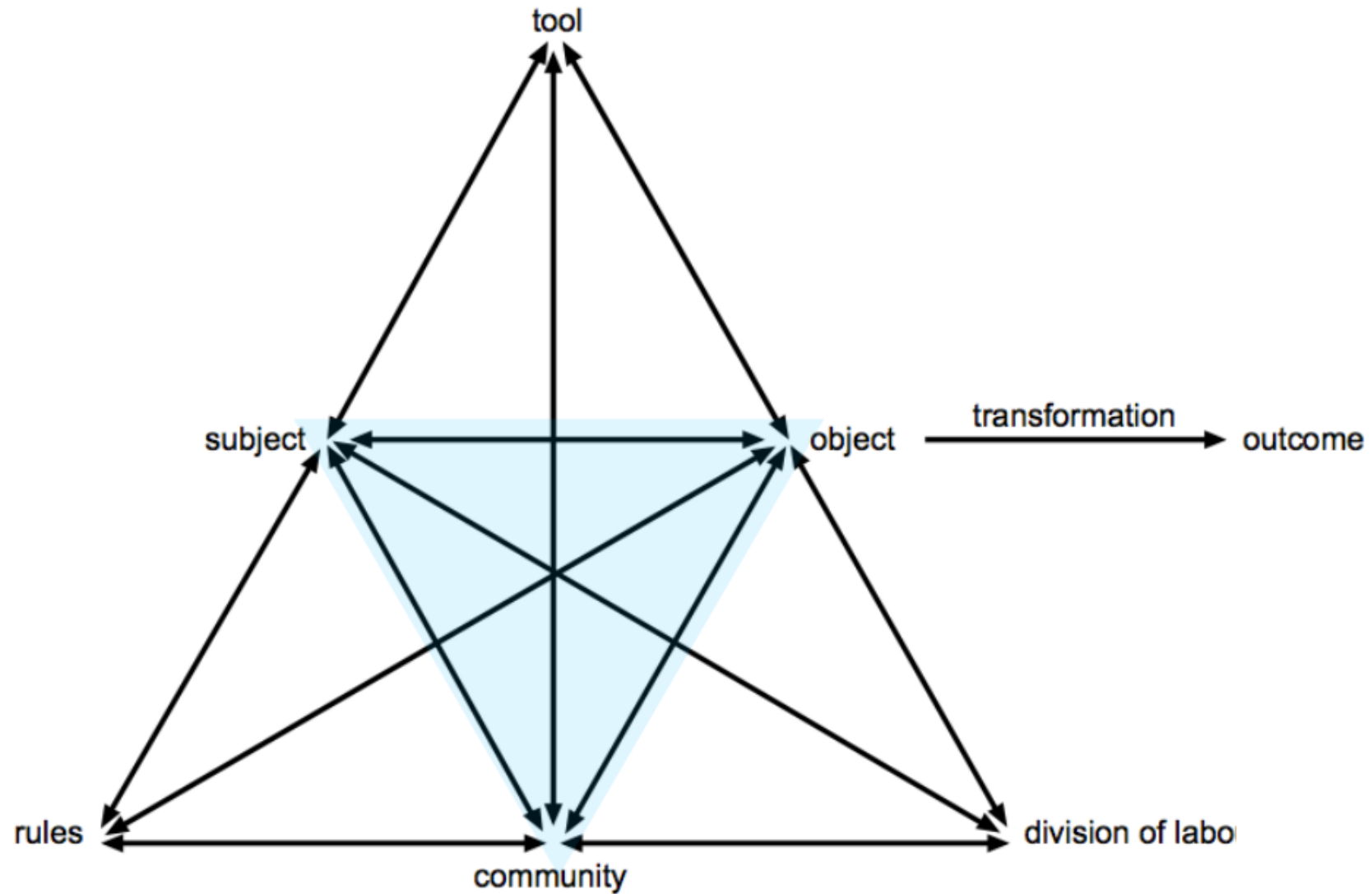
- *Actions* can become *operations* [3]
 - Learning how to do something
 - Expert driver actions: change gear
 - Operations: depress clutch, move stick, release clutch
 - Novice driver actions: clutch, move stick ...
 - Operations: lift foot, put on pedal, push down, ...
- *Operations* can become *actions* [3]
 - Breakdown situations
 - Clutch gets stuck; unfamiliar car ...
 - *present-at-hand* ↔ *ready-to-hand*



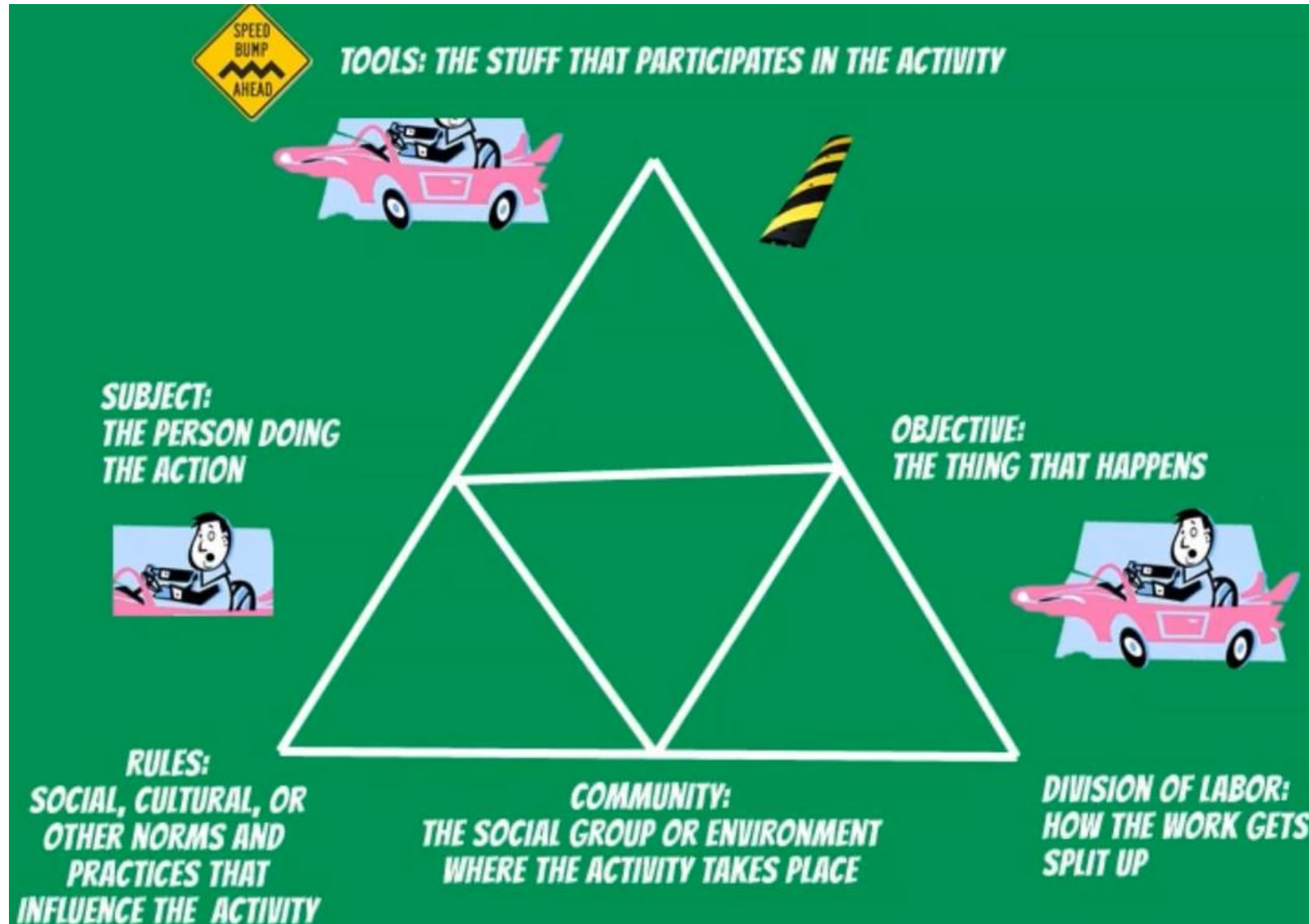
Simple Activity System



Full Activity System



Full Activity System



Taken from the youtube video that can be found here: <https://www.youtube.com/watch?v=mb-3ufwK6U0>

Contradictions

- Also known as “tensions” [4]
- Potential issues within the system [4]:
 - Where might things go wrong (breakdown)?
 - How might things change & develop?
 - Identify these by examining system
- *Types [4]:*
 - Primary contradictions (*within a component of the system e.g., driver does not now how to drive [for subject ↔ subject]*)
 - Secondary contradictions (*between different components of a system, e.g., road sign not visible at night [for tool ↔ object]*)
 - Tertiary contradictions (*with new advanced version of activity e.g., learning to drive vs driving a car [for old ↔ new]*)
 - Quaternary contradictions (*with another concurrent activity e.g., driving a car while having a fight with your partner about where to eat*)

Worked-out Example

Scenario:- *SASS-V (Surgical Assistant & Spatial Visualization)*

The SASS-V is a multimodal interface used in laparoscopic surgery. It replaces traditional 2D monitors with a holistic, data-rich environment. The system also enables surgeons to perform surgeries using robotic assistance. System interactions modalities include:

- **Haptic/Tactile Input:** The surgeon uses force-feedback "tele-manipulators." The system resists movement if the instrument is too close to a major artery, providing physical "guidance."
- **Voice/Audio Input:** The surgeon uses voice commands to switch camera angles or request patient vitals (e.g., "SASS, show MRI overlay").
- **Computer Vision/AR Input:** The system uses 3D depth cameras to map the internal organs and overlays a "ghost" of the patient's pre-op CT scan directly onto the live video feed.
- **Gaze Tracking:** The system monitors the surgeon's pupils; if it detects high cognitive load (dilated pupils) or distraction, it automatically dims non-essential peripheral data on the HUD to reduce noise.

Worked-out Example

Scenario:- SASS-V (*Surgical Assistant & Spatial Visualization*)

Subject: The Lead Surgeon

The individual whose perspective we are analyzing. Their actions are driven by the **Motive** of healing the patient, but their **Operations** (the "how") are now heavily mediated by the SASS-V.

Tools (Instruments): Multimodal Mediation

This is where your CS background shines. The tools are not just "the robot," but the **Signs and Artifacts** that shape thinking:

- **The AR Overlay:** An external representation that "collapses" the distance between the patient's internal anatomy (hidden) and the surgeon's vision (visible).
- **Haptic Feedback:** A tactile "language" that communicates the system's "knowledge" of safety boundaries directly to the surgeon's nervous system.
- **Voice Interface:** A hands-free command protocol that allows the surgeon to stay in the "flow" of the physical activity without breaking the sterile field.

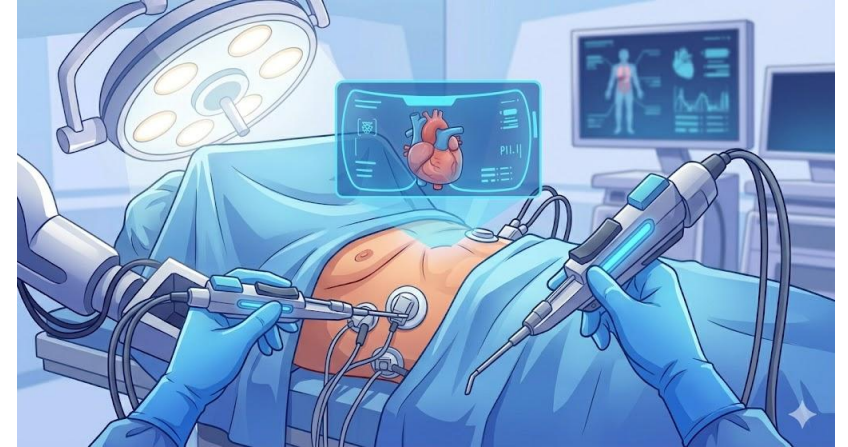


Worked-out Example

Scenario:- SASS-V (*Surgical Assistant & Spatial Visualization*)

Object: The Patient to be treated

In this case, the object is the 'ill' patient who is to receive treatment and undergo transformation into a recovered and cured patient.



Rules: The Constraints

- **Standard Operating Procedures (SOPs):** The literal steps of the surgery.
- **Timeliness:** Every surgery needs to complete within usually acceptable timeframes for that type of surgery.
- **Sterile Protocol:** A physical rule that limits how the "Subject" can interact with "Tools" (e.g., no touching screens).
- **Hospital Liability & Ethics:** The invisible rules regarding AI-suggested actions versus human-decided actions.



Worked-out Example

Scenario:- SASS-V (*Surgical Assistant & Spatial Visualization*)

Community: The "Socio" in Socio-Technical

- **The OR Team:** Nurses, Anesthesiologists, and Tech Support.
- **The Hospital Board:** Who set the "Rules" for using AI.
- **The Patients' Family:** The ultimate stakeholders of the "Outcome."

Division of Labor: The Distribution of Power

- **Human vs. Machine:** Who has the final say? If the Haptic Tool resists a cut the surgeon wants to make, who "owns" the decision?
- **The Surgical Team:** The SASS-V might automate tasks previously done by the Assistant Surgeon (like holding a camera), shifting the Assistant's role to "Data Monitor" rather than "Physical Support."



Worked-out Example

Scenario:- SASS-V (*Surgical Assistant & Spatial Visualization*)

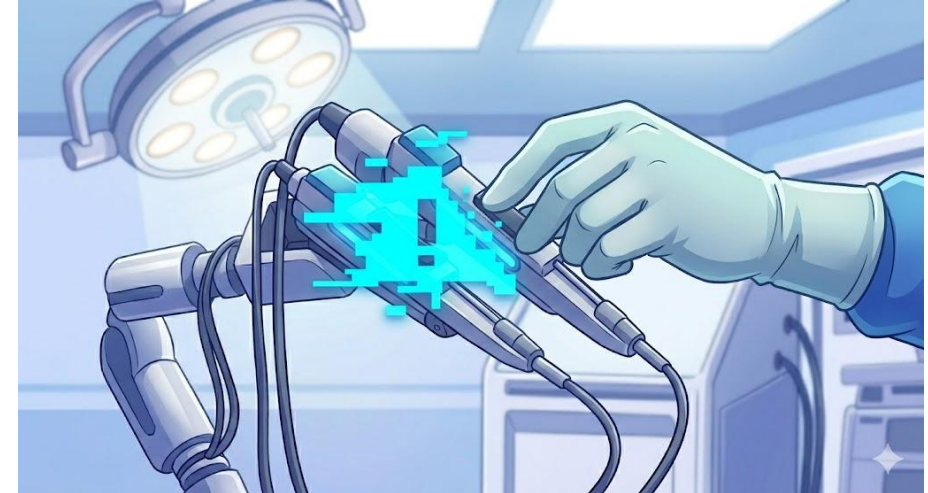
Contradictions:

1. Primary Contradiction (Inside the Tool)

The **Haptic Feedback** tool. Its *use value* is to ensure safety by providing resistance. However, its *technical reality* involves a slight "input lag" (latency). The tool is meant to feel like a "natural extension" of the hand, but the lag makes it feel like an "obstacle." The surgeon is fighting the very tool meant to help them.

2. Secondary Contradiction (Between Tool and Rule)

The issue could be **AR Overlay** (Tool) vs. **Sterile Protocol** (Rule). The AR HUD provides incredible data, but if the system glitches, the "Rule" states the surgeon must not touch anything non-sterile to fix it. If the Voice Command fails to clear a frozen AR pop-up, the surgeon's vision is blocked, but they are forbidden by the "Rules" from reaching up to adjust the headset.



Worked-out Example

Scenario:- SASS-V (Surgical Assistant & Spatial Visualization)

Contradictions:

3. Tertiary Contradiction (Old vs. New Activity)

Here the issue can be **"Traditional Surgery"** vs. **"AI-Mediated Surgery."** In the "Old" activity, the Head Nurse (Division of Labor) was the primary source of patient vitals. In the "New" activity, the SASS-V displays them automatically. This creates a friction where the Nurse feels redundant or excluded from the activity, leading to a breakdown in **Community** communication. The Nurse may stop watching the monitors, assuming the AI has it covered, removing a vital human "fail-safe."



4. Quaternary Contradiction (Between Neighboring Activities)

Here the issue can be **The Surgery Activity** vs. **The Hospital Training Activity.** The SASS-V records everything for "Training." A resident in another room is watching the live feed. The Surgeon (Subject) knows they are being recorded for the "Training Activity," which makes them more hesitant to take risks. The "Training Activity" (the neighbor) is exerting pressure on the "Surgery Activity," potentially slowing down the operation and affecting the **Object** (Patient Safety).



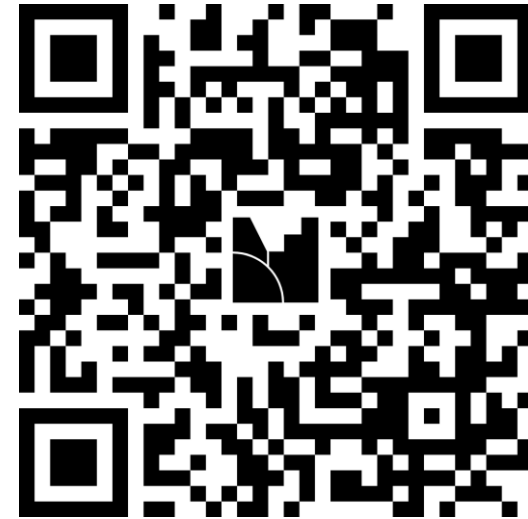
Student Activity

Scenario:- The "GridGuardian" Response

- **The System:** *GridGuardian* is a multimodal AI-orchestrated control suite for city power grids.
- **The Subject:** An Emergency Dispatch Engineer.
- **The Activity:** Managing a localized blackout during a severe winter storm.
- **Multimodal Tools:**
 - **Spatial AR Map:** A tabletop 3D projection of the city showing real-time load.
 - **Haptic Alerts:** The engineer's chair vibrates with different frequencies to signal the severity of a substation failure (avoiding visual "alarm fatigue").
 - **Voice-Activated AI Agent:** The engineer can say, "GridGuardian, reroute Sector 4 power to the Hospital," and the AI executes the complex switching.
- **The "Crisis" (For Analysis)**

During the storm, the **AI Agent** identifies a risk of a total city-wide collapse. To prevent this, it automatically executes a "Load Shed" (a blackout) in a low-income residential neighborhood to save the "Central Business District." The **Engineer** sees this on the **AR Map** and tries to voice-command an override because she knows a "Vulnerable Persons" shelter is in that neighborhood. The **AI Agent** denies the command, citing a **System Rule**: *"Protocol 9: Mathematical priority must be given to high-density economic zones during Stage 5 storms."*

Now identify the mapping to the different elements of the activity triangle and then find the contradictions that may arise from this scenario. Go to the Mentimeter slide to register your answers.



Menti Link:
<https://www.menti.com/alxhu2pjycr7>
 Menti Code: 1506 3876

Thank you for your attention!

Questions?