The Peerspun Project
Concept Evolution & Design Alternatives

1. The Problem Space: Introduction

This report discusses possible design alternatives for on campus travel within Georgia Tech. During the survey process we found that one of the most common problems for students on campus was waiting for the trolley. Also, when asked about bicycling as a possible alternative travel method, about one third responded positively, so long as the bikes were available for free. Apparently many students are not aware of ViaCycle, which provides bikes on campus. Our plan is to create a system that integrates ViaCycle service with the online trolley system. Once implemented it will help students and commuters decide the best possible mode of travel depending upon their preference.

2. The Process: Group Meetings

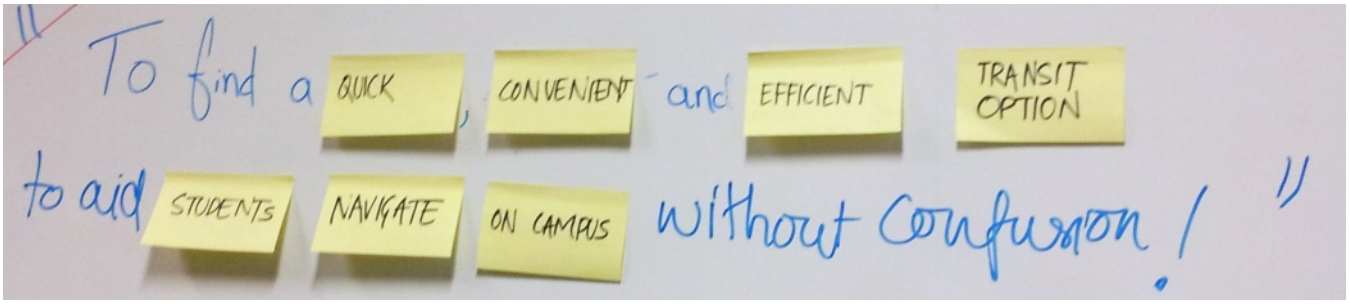
The group met on a number of occasions to determine the direction our brainstorming sessions should focus on.

2.1. First Meeting: Concept Generation

The first meeting started of with understanding the Problem Space and questions that need to be addressed by the system. We came to find out that we were looking for a solution that solves

- undependable Buses on the Campus
- the problem of being late for classes
- viaCycle's visibility on campus
- the problem of deciding between walking or waiting for the bus
- finding places on the campus
- problems with walking: tiredness, sweat, uneven terrain

The keywords that resonated with our problem space and user group were - Quick, Convenient, Efficient, Transit Option, Navigation, Confusion, Students and Campus.

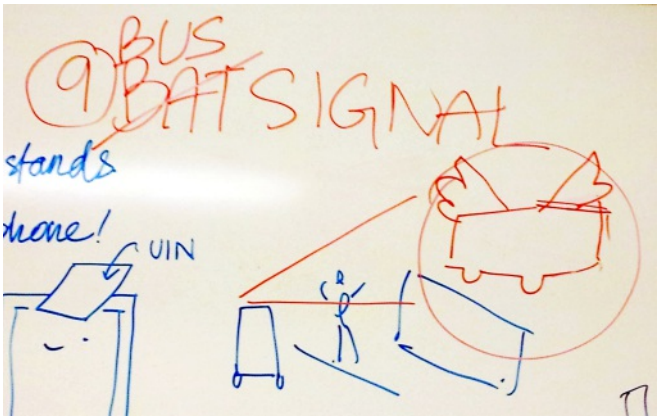


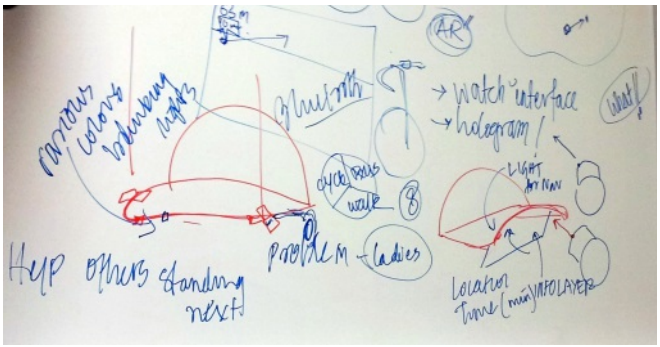
We decided to work specifically on a "transit choice decision aid for GT students."

2.2. Second Meeting: Informed Brainstorming

This meeting was our first "informed brainstorming" session to develop as many divergent ideas as possible. Here, the group took turns sharing ideas we had previously worked on alone, as well as developing new ideas together based on combinations of aspects from prior ideas. The short list of proposed designs we considered were as follows:

1. **Text to Go:** Simple text-based "Best Course" phone directions system
2. **Cycle Stands:** LED lit viaCycle stand displays (with map system incorporation)
3. **Transit Score:** Participatory website/ mobile app system. Allows users to compete for (and share details of) best campus transit times, ranked on a leader board
4. **Tactile feedback navigation systems:** ring / wristband vibration feedback devices
5. ViaCycle integration with Bus Stands
6. **Augemented Reality:** Transparent glass navigation system (interface similar to google glass)
7. **Hat-based navigation by light**. Also considered similar lanyard-based system
8. **Bus-Signal! ...Bike Signal?** Light projecting position/availability into the sky
9. **AR Smartphone transit information system**
10. Bus stop projection of interactive campus map for transit information system





Our final choices were amalgamations comprised of the most interesting and diverse qualities from many of these basic concepts.

The hat interface (#7) was morphed into a version of the transparent glass AR display (#6). It initially included a fold-down, transparent "infolayer," but that was abandoned to emphasize the simplicity of the light navigation system. It also initially incorporated smartphone based input (like that of #1), but was scaled back to use the simpler voice recognition input while in transit. After considering other wearable devices, such as a watched-based system, we chose the hat over all other options because it seemed most novel--none of us had heard of such a simple, elegant interface. We went with light-based navigation (#7) over vibration (#4) because the means of relaying spatial navigation information seemed more intuitive. Also, the lit-up hat would look cooler.

It was necessary to choose between the 3 phone based systems (#1, #3, & #9) on the grounds of which provided the most added benefit and novelty in contrast to the other two designs. Since we had removed the AR functionality from the hat interface, but still wanted to explore the possibilities of such a system, we went with #9. This concept also provided the best means of incorporating the option to navigate through environments not normally traversed, such as cutting through buildings on foot. Another benefit may be to tailor route information to those with reduced mobility, providing faster and more accessible transit routes.

Of the structure and/or display-based systems (#2, #5, #8, #10), the interactive bus stop clearly had the most potential to develop an all-encompassing transit decision aid, as well as an engaging user experience. Because it would only provide transit decision making on-site, we thought that it would best be coupled with one of the mobile options if we were to develop it further.

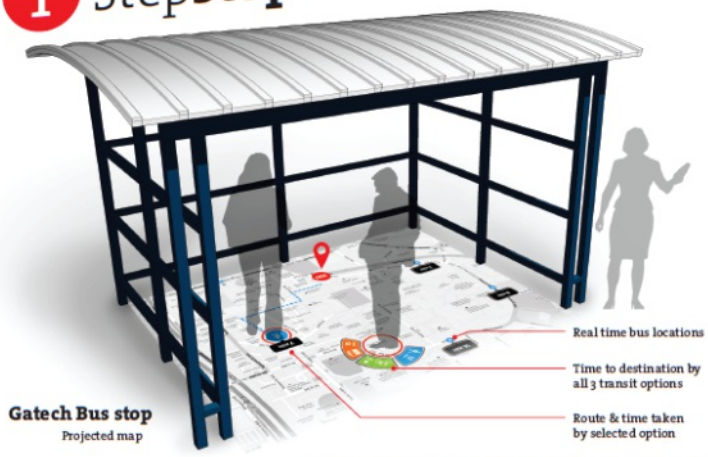
The Poster

the peerspun PROJECT

"SHOULD I WAIT FOR THE STINGER? OR SHOULD I JUST WALK INSTEAD?"

Decisions, decisions..

idea 1 StepStop



Gatech Bus stop
Projected map

"Projected interactive campus map to help users choose the quickest transit option"

64% Almost two-thirds of the Georgia Tech students are late due to **delays** in transit.

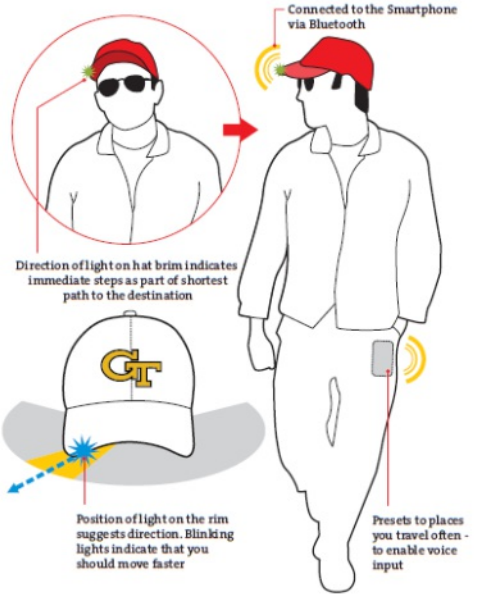
48% Almost half of the students blame this on the **unreliable** bus service.

33% Almost a third of the students would take up biking if given **free bikes**.

idea 2 GoGlow

"A Tangible user interface (TUI) that uses color LEDs and voice commands to navigate inside campus"

Color of the light suggests best transit option



idea 3 SpinPointAR

"Augmented Reality smartphone app to find approaching buses, available bicycles and walk-able routes"

Photos: https://photos.comm.gatech.edu Icons: thenounproject.com www.peerspun.com

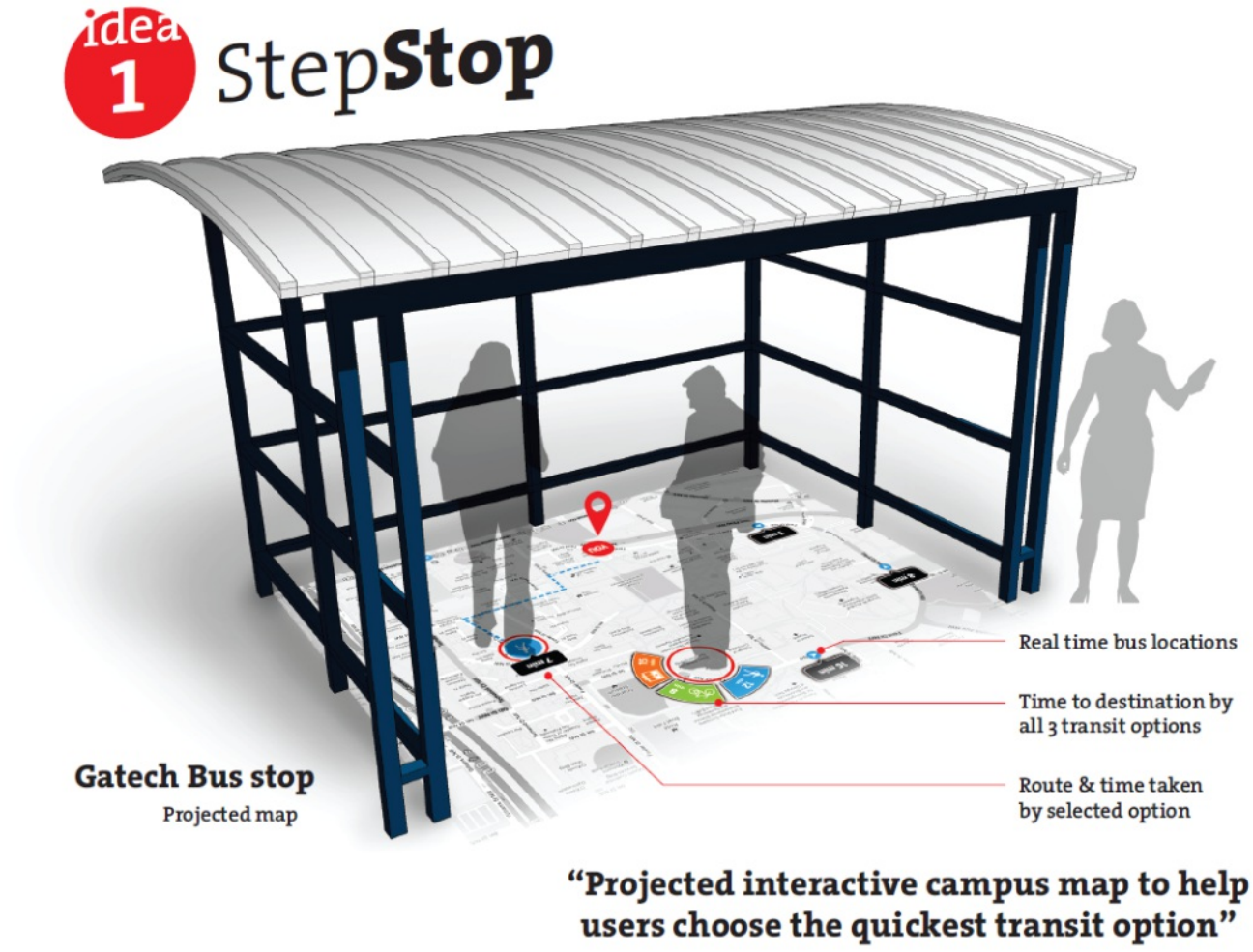
2.3. Third Meeting: Making Prototypes

During this meeting we continued to develop the final choices we planned to present during the poster session. We also worked on creation of poster designs, systems specifications, and prototypes.

3. The Outcome: Design Alternatives

3.1. StepStop: Interactive Bus-stop

This concept involves the projection of an interactive campus map on the floor of a Stinger bus stop. Also incorporated on the map are real-time bus locations and ViaCycle stands with available bike counts. Users may stand on the map in a position corresponding to their desired destination, which will then open up a pie chart with time estimates for transit by foot, by bike, and by bus/trolley. Selections are then made by pressing down by foot on the pie chart menu options.

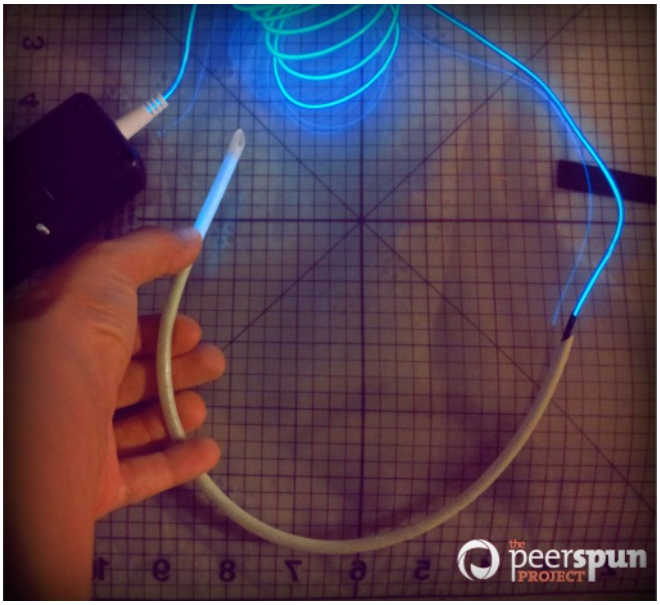


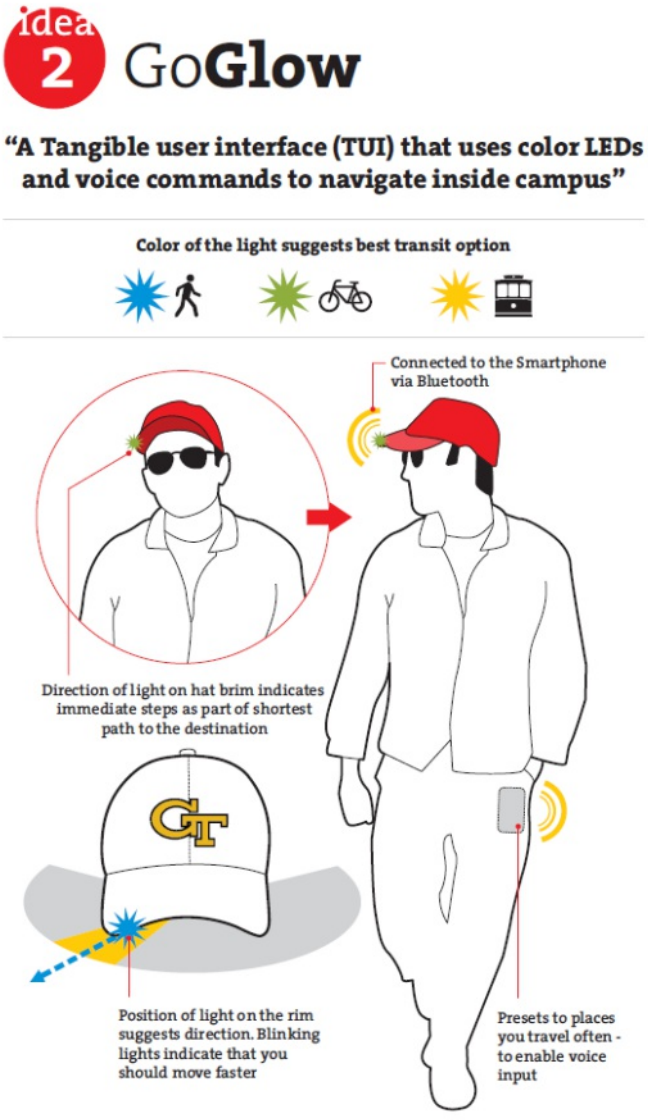
"Projected interactive campus map to help users choose the quickest transit option"

The actual scenario was replicated on a smaller scale with a model bus stand and a trolley. The prototype made for this design was essentially an HTML page containing the campus map projected with an iPad. The evaluators were prompted to touch the screen at different locations to find the best possible options of transit with times listed alongside.

3.2. GoGlow: Wearable Interface

This system, mounted on a cap, incorporates a tangible user interface (TUI) comprised of color LEDs and voice command presets to navigate on campus. The color of the light corresponds to the quickest transit option based on the user's location. The position of the light on the hat brim indicates the direction of steps to take in order to follow the shortest path to the destination. Blinking lights while in transit may indicate that the user should proceed more quickly, or that the user has passed a turn. They may also be used to confirm the destination choice at onset of travel--three blinks for preset 3, for example. The cap is connected to a smartphone via Bluetooth, with voice-activated presets enabling quick, effortless navigation to familiar locations throughout campus.





The conceptual prototype (above) involved manual positioning of the light on the edges of the cap. The light could be readjusted in different orientation as the user's head turned around. Further, on delay the light blinked on 2 presets – slow and fast. This gave the user a fair idea of the system.

3.3. SpinPointAR: Augmented Reality Application

This augmented reality app allows the user to select a preferred mode of transportation. By pointing the mobile device toward the desired direction, the application provides details about the selected transport option. The three available modes are Trolley, Bike and Walk.

Trolley: On selecting 'Trolley,' the user may point toward the direction from which the trolley will come. Depending upon the location and information available from NextBus/trolley services, the application will

show details such as estimated time of arrival for the trolley and vacancy inside each bus.

Bike: When the user selects 'Bike' the application will pinpoint the nearest available ViaCycle stand in that direction. Along with location, the user is also informed about the number of bikes available on that particular stand and the distance of the ViaCycle stand from the user's location.

Walk: The user can choose the 'Walk' option to travel by foot towards the destination, in which case a destination may be entered by typing or speaking the destination name (e.g. CRC). In this mode, the application will choose the best possible route for pedestrians. The screen will display an arrow that suggests the particular path the user should walk.

4. Poster Session Feedback

4.1. StepStop

Evaluators were really excited with the concept of an interactive bus stop. They could immediately relate to the problem they had faced on campus. The fact that they could see the real time position of the buses running without having to take out their smartphones was something that connected with them and was continuously referred to as 'well adapted' and 'efficient'. Further, the decision making task seemed much easier and straightforward to the evaluators with Stepstop. The fact that the system could intelligently guess the time taken for all the parts of the journey - walking, cycling or bus and sum it up to provide a single time per journey could prove to be a 'helpful' functionality according to the evaluators. Although a few concerns were raised in terms of brightness of the projected system, and the proximity of the users of the

system, the unanimous view was that the waiting experience would definitely be more engaging and informative.

Positive feedback:

- Interactive and engaging experience decreases perceived wait time
- Real-time position of all buses could prove handy
- The interaction is learnable, memorable and efficient
- Summative transit times are really helpful in decision making

Possible Issues:

- What if two persons have to go to the same location or nearby locations?
- How do you project the lights on a bright sunny day? Visibility might be an issue.
- There's a possibility of theft or damage to the system in real life scenarios. Safety is an issue
- Crowding might make the interface unusable
- What would the user do to get location information once he is off the bus stop?

Suggestions:

- To make a jump game out of it
- To use the back side of the bus stop as a projector screen in order to avoid glares of the sun, maintain cleanliness, increase visibility in general.
- Integrate with other systems to increase viability.

4.2. GoGlow

The voice activated, color-coded LED based intelligent tangible user interface got good reviews from the evaluators. They found the system to be simple and easy to use. They agreed to the fact that the system was the fastest in providing the decision to the user with minimal distraction. Again, it could be carried around as a navigation tool--this was another added advantage. The overall reaction was that the system was novel but there might be limited adoption due to the reluctance of some to wear a hat for such purposes. This simple system does one thing, and it does it well with minimal confusion- *a great combination.*

Positive feedback:

- No screens or user action involved implies fastest decision making
- Can be carried as a navigation system
- Presets can be used for quick actions
- Blinking lights provide good feedback to the user

Possible Issues:

- Everyone may not be willing to wear a cap around the campus
- The light changes might not be noticeable to the user all the time
- Its difficult to recall and interpret what the color of the light means in each case. This makes the system less learnable and memorable
- Safety / Constraints: Presets can be misunderstood by the system in case of wrong pronunciation or in crowded areas. There is no current feedback stating what direction the light is pointing to. For example, the user says Klaus and the system mis-interprets it as Clough.
- Privacy concerns: Some users might not be

comfortable with others being able to see which way they are heading

Suggestions:

- To add constraints to the system to decrease misinterpretation
- To add a visual / audio feedback so that the user knows where he/she is heading, or to know the distance of the next target
- To make similar Visors for women to sport
- A more generally accepted device might be a pin to attach to backpack or bag

4.3. SpinPointAR

"Oh! It will be so COOL to have an Georgia Tech AR app on my smartphone".

It was seen that the evaluators immediately related to the 'practicality' of this option and appreciated the 'experience' bundled with it. The behavioural response for this idea also hinted at the potential learnability and flexibility of the system. The evaluators could also relate to the times at the bus stop when they have decided to walk when the trolley is just around the corner, or when they find out that the trolley they waited so long for is already full. The most common suggestion received for the idea was to merge it with the functionality of the first idea (StepStop).. These findings encouraged us to further explore on-campus travel for enhancements/modifications.

Positive feedback:

- "I can now see buses round the corners"
- The trolley occupancy graph is useful
- Easy, straightforward interactions (need to be refined further)

Possible Issues:

- While cycling, it is really difficult to use Augmented Reality to find the next viaCycle stop
- Too much effort. Slowest time for decision making
- Showing all the trolleys running on the campus might make the interface really clumsy

Suggestions:

- Decide what buses to show and what not to. Make the UI minimalistic to the maximum possible extent
- Add 2D (from 1st idea) to the 3D (from this idea). This can be used when the user is actually cycling from one place to another
- Make the decision making time faster

5. Concept Integration

While each of these concepts has merit as a stand-alone system or device, many would be best suited to integration in a larger system of devices and services working together to aid with the decision-making process in all conceivable circumstances. The situational and environmental contexts within which each concept is best suited to address are varied and may overlap, but each does seem to serve an available niche. The main StepStop interactive system is only available at bus stops locations. GoGlow would be useful anywhere, but its simple, hands-free feedback system would be most useful while on the go (walking or biking especially) compared to the other options. SpinPointAR is not so useful while driving/biking, but good for navigation through buildings (where a signal is available). Another possible addition to this combination of systems would be a text-based phone direction system. This would provide a simpler and possibly quicker solution than might be possible with the AR smartphone app.

6. What we learnt from the exercise

We learned that:

1. Always remember to take pics

2. Crazy suggestions help create awesome ideas

3. Brainstorming sessions really are most productive when group members come in with sets of unique ideas, and then are able to combine and refine them together. Some of our best designs were developed through inclusion of aspects from multiple other ideas, which were then refined to cover divergent types of models, systems, or modes of interaction.