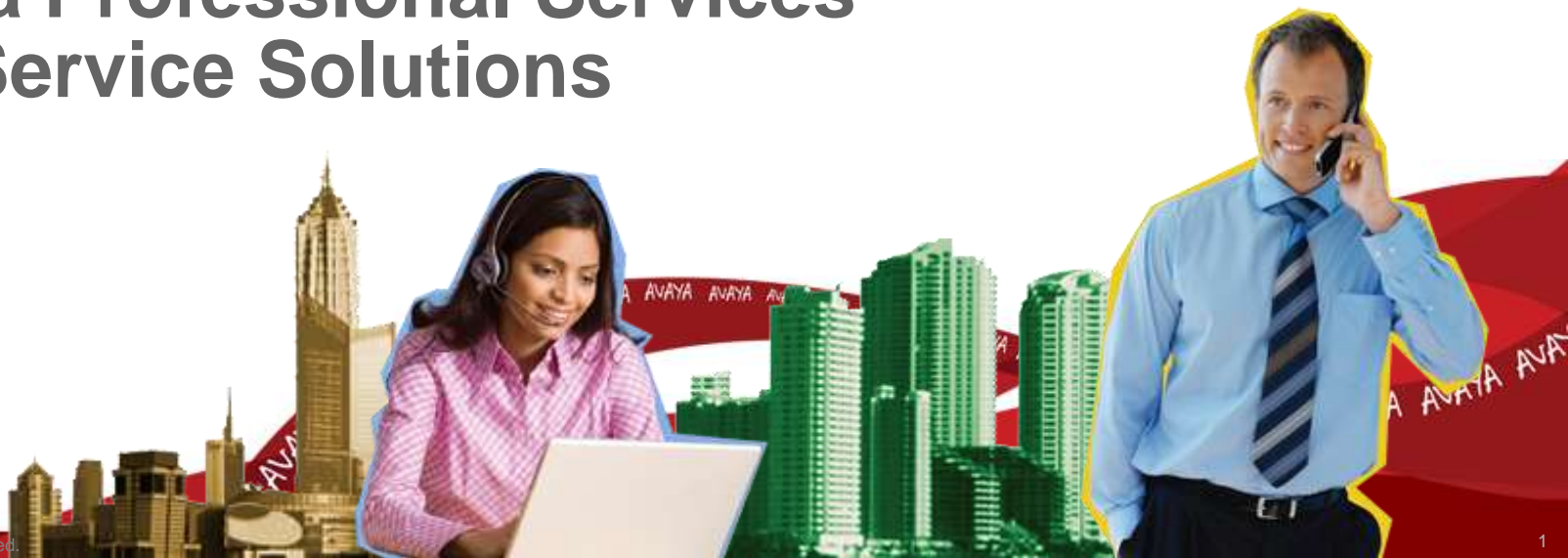




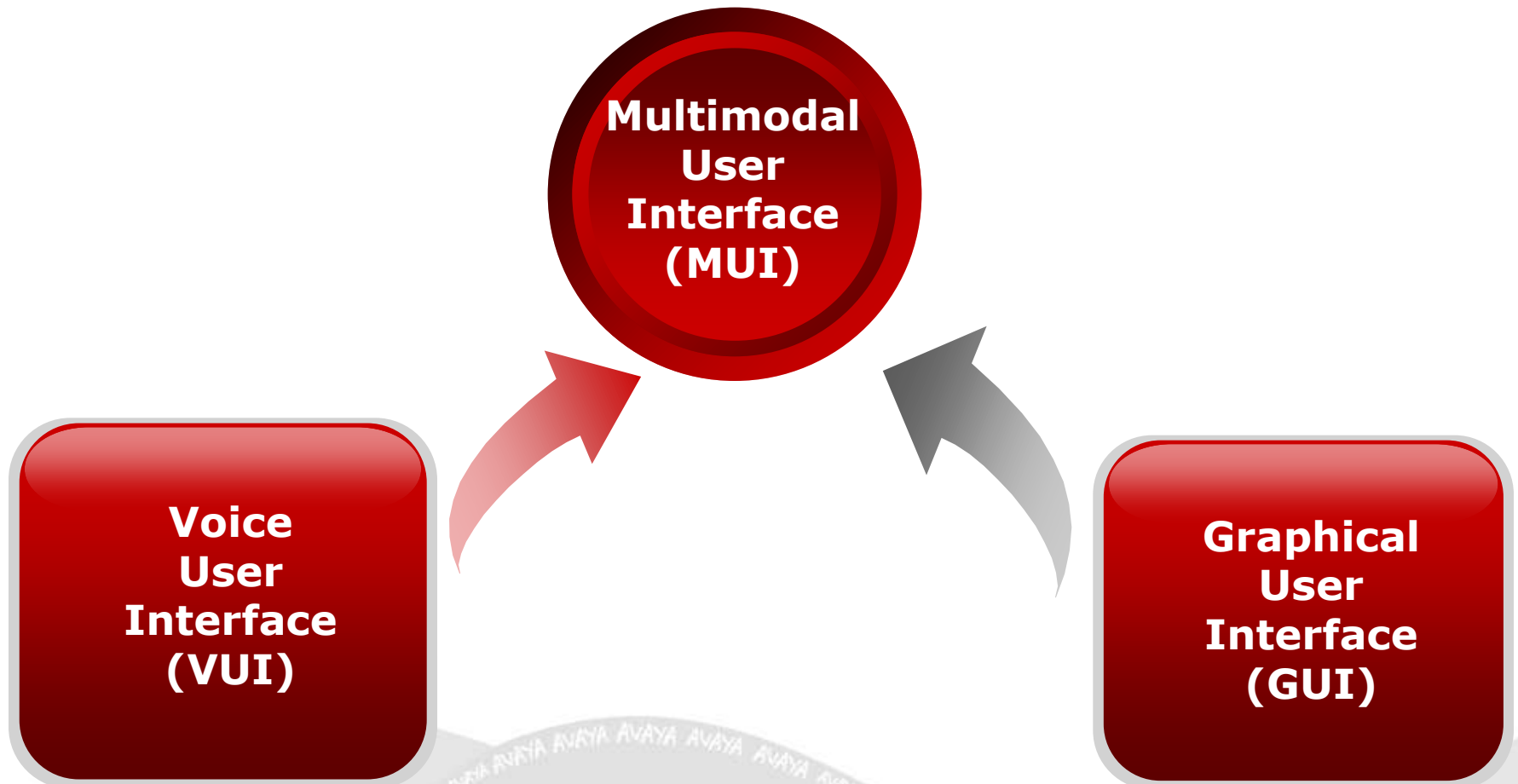
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User Interface Design Challenges in Multimodal Interaction

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Multimodal Interaction On Mobile Devices



Multimodal Application Types

- Differences in availability of modalities within one interaction:
 - VUI-only interaction with GUI providing pictures to supplement (no input to the GUI) or vice versa
 - VUI-only interaction followed by a GUI-only interaction
 - Interaction where modalities alternate (must use only one modality at some points during the interaction)
 - VUI and GUI interaction where both modalities are available at all times

Why would you use it?

- Flexibility of Interaction
 - Choose the modality that's most applicable in the user's current situation
- User Control
 - Allows users to choose how they interact with a system
- Efficiency
 - Users are able to use the modality that is the most efficient for the information presented
 - e.g. A visual list versus an auditory list
 - e.g. Saying a credit card number versus typing a credit card number
- Fun
 - New technology, New way to interact with a system

Voice User Interface Design Considerations

- Which Tasks to Automate
 - Repeatable, mundane tasks with large calling populations
- Order of Task
 - Consistent with user's mental model
 - Consistent with business rules
- Which Information Does the Caller Need to Provide
 - Login procedures and transactional processes
 - Information format
 - Numeric or Alphanumeric Information - Patterned or Not
 - Number of Menu Options
- What Stored Information Can the System Use
 - Available for dynamic (even personalized) experiences

Voice User Interface Design Considerations

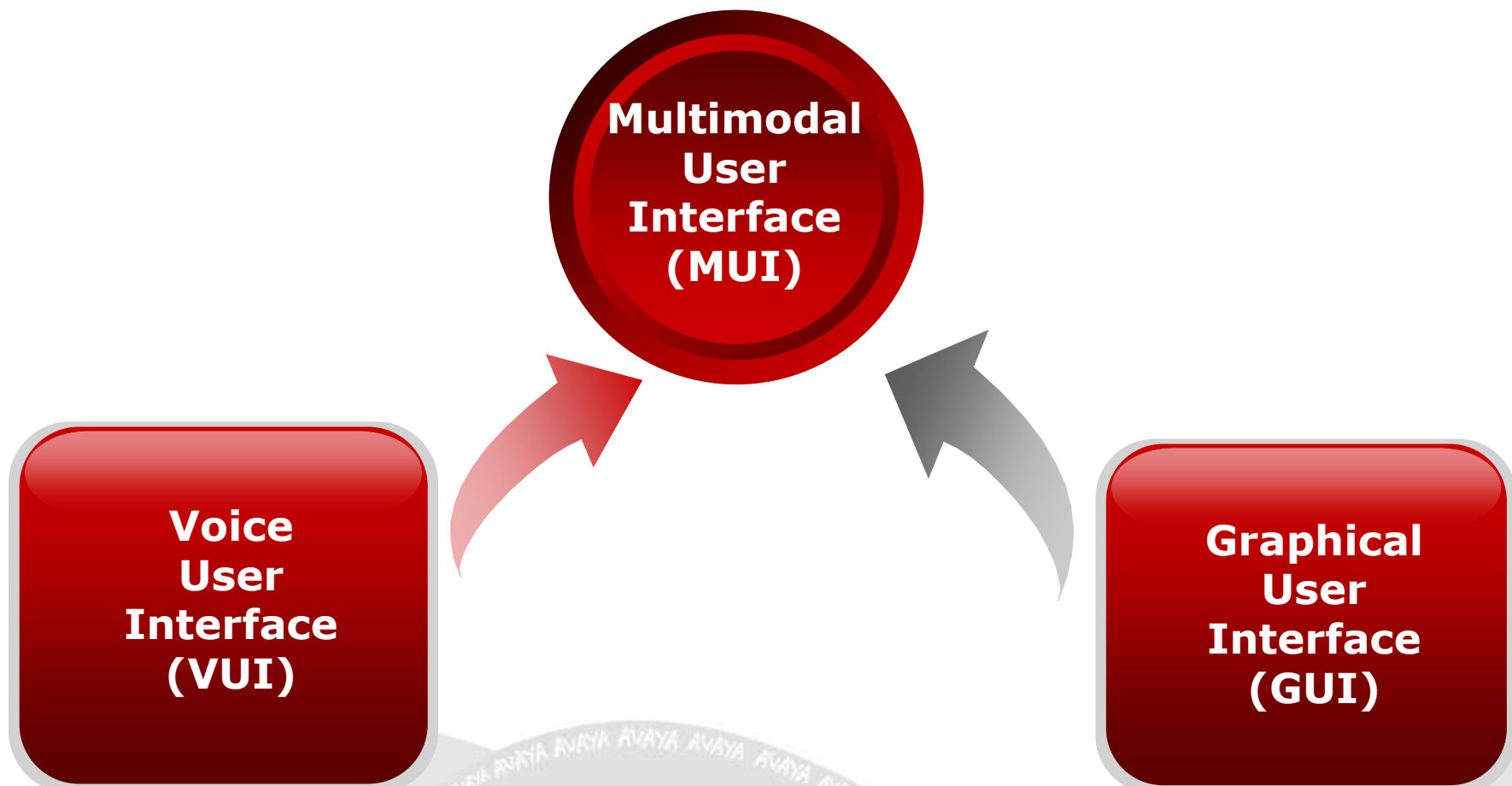
- Overall Tone and Feel
 - Voice talent, word choices, and earcons all help to create a specific persona
 - Matches the brand image of the business
- Prompting
 - Clearly defining the acceptable responses and constraining open-ended speech when necessary
 - Terminology and verbiage should be appropriate for the user population
 - Terminology and verbiage should be consistent
- Error Handling Strategy
 - Typically 3 errors (timeouts or retries) and transfer out
- Confirmation Strategy
- Hints and Landmarks for Universal Commands

Graphical User Interface Design Considerations

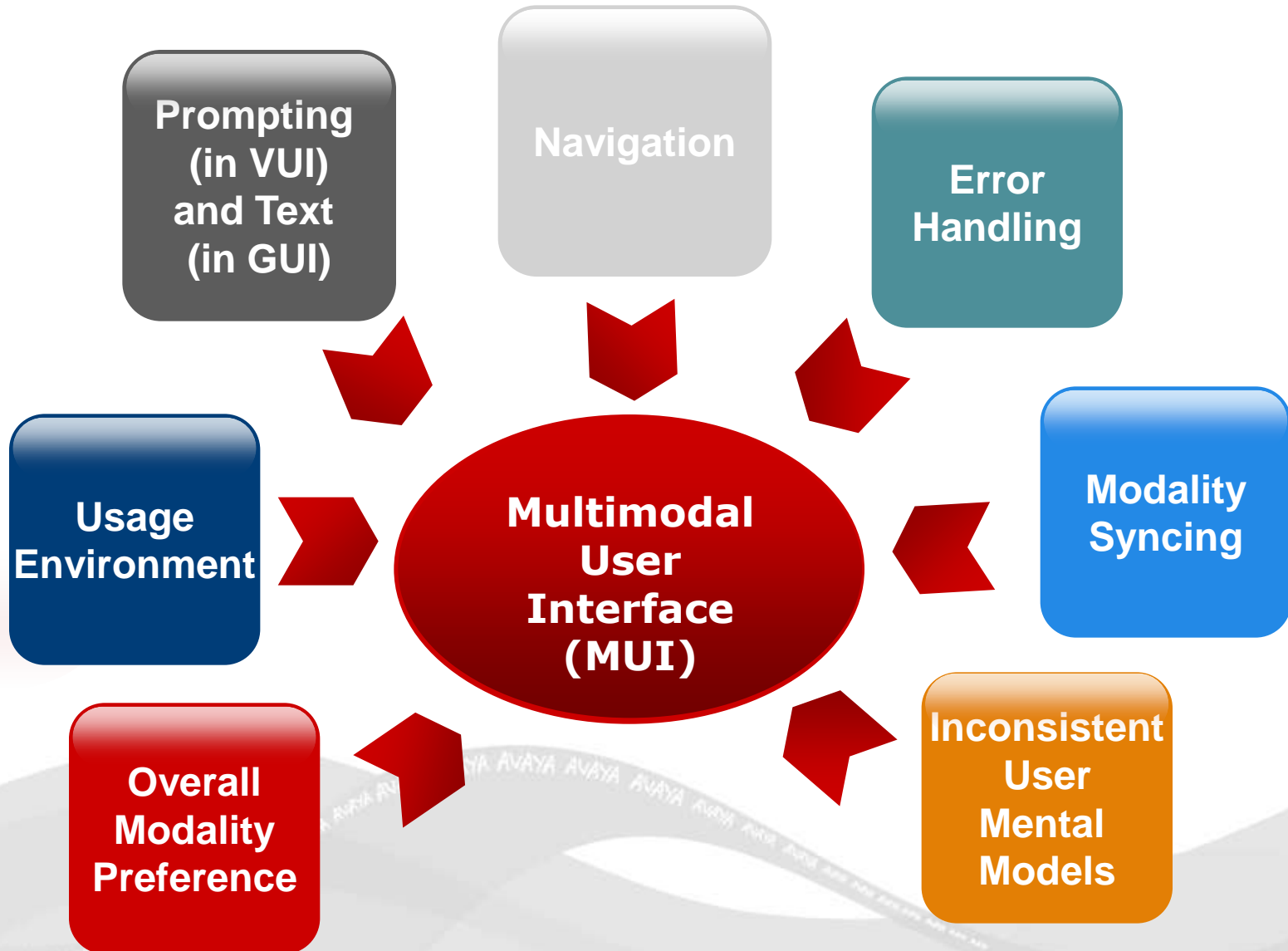
- Which Tasks to Automate
 - Repeatable, mundane tasks with large user populations
- Order of Task
 - Consistent with user's mental model
 - Consistent with business rules
- Which Information Does the Caller Need to Provide
 - Login procedures and transactional processes
 - Information format
 - Numeric or Alphanumeric Information -Patterned or Not
 - Presentation Format of Options (e.g. drop-down box or free-form text box)
- What Stored Information Can the System Use
 - Stored data available for dynamic (even personalized) experiences

Graphical User Interface Design Considerations

- Overall Look and Feel
 - Page Layout, Colors used
 - Matches the brand image of the business
- Text Format and Verbiage Used
 - Clearly defining the acceptable responses and constraining open-ended input when necessary
 - Terminology and verbiage should be appropriate for the user population
 - Terminology and verbiage should be consistent
- Error Handling Strategy
 - Simple and relevant
 - Allow easy reversal of actions
 - Provide relevant visual feedback (e.g. progress bars)
- Shortcuts and Landmarks



MUI-Specific Design Challenges



Overall Modality Preference

- Based on prior experiences and/or general tendencies, users may prefer one modality over the other
 - Some users may have a bias to use verbal or touchtone input
 - Some users may have a bias to use text or touch input
- Some users will interact with the system choosing between modalities equally
- Users may change their mode of interaction depending on the mobile device being used
- Users may change their mode of interaction depending on the task they are trying to accomplish
- The most usable MUIs will take user preferences into account and adapt the interaction to them.

Usage Environment

- Users will change how they interact with the system depending on their surroundings
 - Users in quiet situations will typically prefer speech
 - Users in noisy environments (e.g. the subway) will typically prefer textual or touch input
- Because these devices allow users to be mobile, the environment can change during a single interaction and will affect how users choose to interact with the system
- Privacy, Discreetness, and Hands-Busy Situations all affect how users want to interact with the system
- The most usable interfaces will allow users to change their mode of interaction at will as their environment changes.

Prompting and Text

- The prompting heard in the VUI and the text shown on the GUI should be consistent.
- Prompting and Text can be modified to be more modality neutral

For example:

- Typical VUI prompt: When you **hear** the one you want, just go ahead and **say** it.
- MUI prompt: When you **find** the one you want, just go ahead and **say** it or **select** it on your screen.
- Prompting can point the user to look back at the screen and vice versa
- Text on the GUI might also need to be numbered to match the touchtone options in the VUI

Navigation

- MUI applications typically work best with a guided structure that allows the user to proceed through a series of steps to complete a task
- Guided structure will typically use directed dialogue in the VUI where users have a limited set of acceptable responses
- The GUI will also need to be constrained and display the acceptable choices (rather than having free-form text fields)
- Differences between the logical order of steps in a VUI and the logical order of steps in a GUI will need to be considered
- What navigational commands are active will also need to be considered
 - Go Back? Main Menu? Start Over?

Error Handling

- Speech Recognition Errors
 - Occur when the system doesn't recognize something the user said
 - Does 3 Errors and Transfer still apply?
 - Should you even transfer out to a representative?
 - Upon escalating errors, should the system point the user back to the GUI? Still provide touchtone fallback?
- Typical GUI Errors
 - Occur when the user inputs something in the wrong format or when the user fails to input something required
 - How does the speech system handle typical GUI errors?
 - Should the system point the user back to the VUI if multiple GUI errors have occurred?
- Because users have the choice of modality, are users more tolerant of errors?

Modality Syncing

- What happens when one modality completely fails?
 - Is the other modality aware of the failure?
 - Does the failure change the experience in the continuing modality?
- What happens when one modality is out-of-sync with the other?
 - Long latency times to reload a page
 - User barges-in in the middle of a prompt and says their response
 - User barges-in in the middle of a prompt and touches or texts their response
 - Is the other modality aware of the synchronization problem?
- What happens if the other modality recovers in the middle of the interaction after a failure or synchronization problem?

Inconsistent Mental Models

- Users come to VUI and GUI interactions with specific mental models of how to interact with each type of system
- In VUI interactions, users are typically familiar with the terms “Main Menu” and “Representative” even when not prompted for them
- In GUI interactions, users are typically familiar with the terms “Home Page” and “Back”
- When the mental models conflict, the user may be unsure how to interact with the system
 - Will the user ever say “Home Page” to go back to the Main Menu?
 - Will the user want a “Representative” button on every GUI page?
- A systematic framework for interacting with MUI applications will need to be created.

Conclusions

- In designing user-friendly MUIs, basic VUI and GUI design principles must be considered.
- However, in creating a system that allows users the choice of multiple modalities, new MUI-specific challenges must also be considered including:
 - Overall Modality Preference
 - Usage Environment
 - Prompting in VUI/ Text in GUI
 - Navigation
 - Error Handling
 - Modality Syncing
 - Inconsistent User Mental Models
- By accounting for these MUI-specific challenges, multimodal applications for mobile devices will become more useful and more usable.

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