**Interaction Design:**

As a universal, culture-independent method of building a sentence was a critical component of this assignment, all decisions made in regard to how the user interacts with the system to build the sentence were carefully chosen to support equal understanding among all users. The main drag-and-drop transfer of icons from the icon bin onto the canvas was designed as a metaphor for assembling a collage, and any user could reasonably be expected to understand this intuitive dragging process by identifying it with the real-life activity it represents. This also extends to the method of deleting individual icons, which requires the user to drag icons back into the bin to remove them from the canvas. While these actions will require a demonstration beforehand for users to understand what type of interaction has been implemented, they will have little to no difficulties in recalling and carrying out this quick, natural process after learning it once; this is the main reason the drag-and-drop design was used over other less intuitive possible design choices, such as nested pie menus generated from a single click on the canvas.

Connecting icons (with dashed lines for modifying adjectives and arrows for verbs or other connectors) is performed automatically when the modifying icon is dragged onto the object it modifies, producing the suitable connector and snapping the icon to an appropriate nearby location. This process is automated to standardize the appearance of sentences and ensure that users cannot create their own conventions for connecting sentences: as there is only one way to connect an adjective and its object, for instance, every user will produce identical sentences for the same icons, rather than some having arrows (pointing in either direction between icons) or the modifying icon being placed randomly on the screen. This generates universality in the final appearance of sentences, and all users will understand the sentence conventions in this interface after watching the instructional video and building a sentence for themselves.

**Screen Design:**

As the intended users are elderly, accounting for visual disabilities is a major concern in ensuring that the program functions as expected. Following this requirement, the canvas used for placing icons and building a sentence is made as large as possible, providing a clear view of what the user has written so far as feedback. The canvas occupying more than two-thirds of the screen is also conducive to using large and clear icons (described further below), allowing these icons to be sufficiently large for viewing without causing crowding or adding confusion when the sentence is quite long and intricate. Similarly, the icon bin is made large enough to effectively hold rows of up to four icons each, though the unit sizes of icons (described below) allow for varying numbers of row icons while maintaining consistency in arrangement. The user can easily view icons from within the bin to decide whether or not to drag them onto the canvas, and the immediate proximity of the Category Selector and the bin’s scrollbar allow the user to readily move through icon selections in a quick, yet logical fashion

The menus, both the top command bar and the icon bin sidebar, are designed to be as clear and accessible as possible without distracting the user or occupying too much of the screen. In order to minimize the appearance of these menus while building on the canvas, two edges of the screen are used to hold the toolbars rather than simply placing one on top of the other on the top of the screen. Beyond the apparent space-saving effect that maximizes screen space for the canvas and icon bin, this notably separates and partitions the system commands (Back to Chat, Send, Delete, etc.) from the Icon Category Selector buttons, ensuring that users will not confuse the two toolbars and their functions, such as assuming certain category buttons correspond to menu functions (i.e., “People” to “Add contacts”). The menu items are made as large as possible while still remaining inconspicuous during canvas usage, with their associated icons occupying maximum space within each border, to ensure that users will easily view and understand what each button does before pressing it. Lastly, the usage of buttons on toolbars for activating menu commands or switching between categories was chosen in order to make the selection choices as large, clear, and accessible as possible; other types of menus like dropdown or pulldown were considered, but ultimately passed over in favor of toolbars due to their consistent display of all possible choices and customizable button size design, along with appearing more intuitive to users with little experience with computers.

**Icon Design:**

In drawing icons to build the user’s sentence and convey meaning, simplicity and clarity were the key points for evaluating the designs. First and foremost, icons are designed to be large in order to account for poor vision among users, with every icon having a minimum size of 100x100 pixels. However, icons are not constrained by this size, and longer/taller icons have widths/heights consisting of larger multiples of 100 pixels. This variable width of icons is used to provide clear images of all types of objects or concepts, with naturally elongated objects like buses not being forced to uncharacteristically inhabit a constraining square. This choice was made over the use of fixed-size icons, which would require either the scaling-down or skewing of elongated objects until they fit the size, at which point they may be too unclear to interpret. Furthermore, the usage of multiples of 100 in icon dimensions allows the icons to still remain neatly arranged in the icon bin even when they have different sizes by establishing 100 pixels as a unit size for icons. The bin, designed to hold four units of width, can therefore display the largest icons such as “last” in-line with smaller ones without sacrificing any space, allowing for a neat and consistent design that evenly groups together all icons in each category.

For the actual design of icons, conveying a clear and unambiguous meaning with as few intricacies as possible was the primary goal when designing the images. Each icon involved with the creation of the sample sentence is designed to correspond to a single noun, verb, or adjective (allowing all connections and modifiers to be represented with the automatic dashed lines and arrows), and every design was evaluated first for its cultural universality before all else. As the icons are made for a public chat system between elderly users, general knowledge and immediate familiarity with the represented concepts trumped factual accuracy; for this reason, icons such as London and Hong Kong used iconic and familiar landmarks such as Big Ben and the Tian Tan Buddha rather than their flags, which many users were unable to identify. Abstract concepts, such as “year”, “past”, or “sister” were designed as diagrammatic, primarily to free these ideas from any cultural biases that would inhabit similar designs made for Western audiences (i.e., “past” utilizes the progression of technology and a reversed arrow, rather than the original idea of simply using a timeline with a backwards-facing arrow). Using these conventions, the icons will ideally be distinguishable and understandable (albeit with some thought requirements for the more intricate icons) for all users involved, rather than relying on Western concepts to design icons immediately recognizable for American users but confusing or unfamiliar with other nationalities. This will provide the greatest opportunity for the user to find, recognize, place, and read the exact words they are searching for, streamlining and enabling conversations between those of various cultures.