# Comprehensive Layer Panel System Explanation

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## I. Visual Design

### Panel Location and Layout

- Positioned in the bottom right corner of the canvas

- Vertical arrangement of elements

- Compact design to minimize space usage

### Button Design

1. Layer Buttons

- Square buttons, each 30x30 pixels (size adjustable as needed)

- White background with a 1px black border

- Centered black number inside each button

- Numbers represent the order of creation (1, 2, 3, etc.)

2. 'Add New Strand' Button

- Rectangular button, wider than the layer buttons (e.g., 90x30 pixels)

- Distinct color (e.g., light green) to differentiate from layer buttons

- Black text: 'Add New Strand'

### Button Arrangement

- 'Add New Strand' button fixed at the bottom of the panel

- Layer buttons stack above the 'Add New Strand' button

- Newest strands (highest numbers) appear at the top of the panel

- Older strands (lower numbers) stack downwards, closer to the 'Add New Strand' button

- Example order from top to bottom: 3, 2, 1, [Add New Strand]

### Selection Indicator

- Selected layer button has a light blue background

- Unselected buttons maintain a white background

### Hover Effect

- Buttons slightly darken when hovered over for better user feedback

## II. Functionality

### Representing Strands

- Each layer button represents a 'new strand' (top-level strand)

- Only top-level strands are visible in the panel

- Sub-strands (attached strands) are not directly represented in the panel

### 'Add New Strand' Button

- Clicking this button creates a new top-level strand

- A new layer button appears at the top of the panel, above all existing layer buttons

- New layer buttons are numbered sequentially (1, 2, 3, etc.)

### Selecting Strands

- Clicking a layer button selects the corresponding top-level strand

- Only one layer button can be selected at a time

### Editing Mode

- Selecting a layer button enables editing for that strand and its sub-strands on the canvas

- Deselecting all buttons (clicking on canvas) returns to a neutral state

### Sub-Strand Management

- Sub-strands become editable when their parent top-level strand is selected

- Editing or moving sub-strands is only possible when the parent is selected

### Layer Operations

- Option to add new top-level strands (via 'Add New Strand' button)

- Ability to delete a top-level strand and all its sub-strands (could be a right-click option on layer buttons)

- Potential future feature: reordering top-level strands

## III. Implementation Details

### Custom Button Widget (`NumberedLayerButton`)

- Inherits from `QPushButton`

- Overrides `paintEvent` for custom square design with centered number

- Implements hover and selection effects

### Layer Panel Widget (`LayerPanel`)

- Custom widget containing a vertical layout of `NumberedLayerButton` instances and the 'Add New Strand' button

- Manages creation, arrangement, and interaction of buttons

### Button Functionality

- Click event on layer button selects the corresponding top-level strand

- Ensures only one layer button is selected at a time

- Click event on 'Add New Strand' button creates a new top-level strand

### Canvas Integration

- Button selection updates the canvas to edit the corresponding strand and its sub-strands

- Canvas state (e.g., adding sub-strands) is reflected in the layer system

### Data Management

- Maintains a list of top-level strands with references to their sub-strands

- Implements a selection system to track the active top-level strand

### State Synchronization

- Keeps the Layer Panel state synchronized with the actual strand data and canvas state

## IV. User Interaction Flow

### Creating a New Strand

- User clicks 'Add New Strand' button at the bottom of the panel

- New layer button appears at the top of the panel, above all existing layer buttons

- Canvas enters drawing mode for the new strand

### Selecting a Strand

- User clicks a numbered layer button

- Button background changes to light blue

- Canvas updates to show the selected strand and its sub-strands

### Editing Sub-Strands

- With a top-level strand selected, user can edit or add sub-strands on the canvas

- These changes are associated with the selected top-level strand

### Switching Between Strands

- User clicks a different numbered layer button

- Previous selection is deselected, new selection is highlighted

- Canvas updates to show the newly selected strand and its sub-strands

### Deselecting All Strands

- User clicks on an empty area of the canvas

- All layer buttons become deselected (white background)

- Canvas enters a neutral state

## V. Implementation Considerations

### Performance

- Efficient rendering of buttons, especially for a large number of strands

- Smooth interaction between Layer Panel and canvas

### Scalability

- Handle a potentially large number of top-level strands

- Implement scrolling for the Layer Panel if it exceeds the canvas height

- Ensure the 'Add New Strand' button remains fixed at the bottom, even when scrolling

### Accessibility

- Ensure buttons are large enough for easy interaction

- Consider keyboard navigation for the Layer Panel

### Extensibility

- Design the system to easily accommodate future features (e.g., reordering, grouping)

### Error Handling

- Gracefully handle scenarios like failed strand creation or deletion

### User Experience Enhancements

- When adding new layers, consider a smooth animation to show the new layer appearing at the top

- If implementing a scrolling mechanism, consider automatically scrolling to the top when a new layer is added

- Add a visual indicator (like an arrow or animation) to guide users' attention to the top of the panel when a new layer is added