A Generic Framework and Library for Exploration of Small Multiples Through Interactive Piling

Supplementary Material

Fritz Lekschas
Harvard School of Engineering and Applied Sciences

Xinyi Zhou
State Key Lab of CAD&CG, Zhejiang University

Wei Chen
State Key Lab of CAD&CG, Zhejiang University

Nils Gehlenborg
Harvard Medical School

Benjamin Bach
University of Edinburgh

Hanspeter Pfister
Harvard School of Engineering and Applied Sciences
Figure S1: **Grouping and Arrangement Refinement From the Teaser Figure.** After grouping items in close proximity into piles in Fig. 1A3, we further refine the grouping and isolate four piles via manual rearrangement to show overarching concepts in how people think of necklaces. Please also see our Supplementary Video for a recorded exploration of this dataset.
Figure S2: **View Specification.** We exemplify how the declarative view specification (bold source code) enables different pile encodings. In (1), we show the default pile encoding. In (2), we randomized the item offset for partial previewing. In (3), we implemented foreshortened previews. And in (4), we visualize the pile as a gallery preview.
Figure S3: Arrangement and Grouping in PILING.JS. We demonstrate how PILING.JS’ arrangeBy and groupBy methods work. (Top) The arrangeBy('data') subroutine expects an array of item property names (e.g., distanceToDiagonal, noise, and size) to arrange the piles by one, two, or more dimensions. Multidimensional cluster plots are realized with UMAP. (Bottom) The groupBy can take the current layout (e.g., grouping by overlap), item properties (e.g., grouping by cellSubType category), or similarity (e.g., grouping by cluster) into consideration. The cluster subroutine uses k-means clustering with $k = \max(2, \lceil \sqrt{|\text{items}|}/2 \rceil)$ by default.
Figure S4: **Graphical User Interface for Parameterization.** PILING.JS implements several default settings and allows to define custom use-case specific settings. (Scaled-up version of Fig. 10.)
Table S1: **Piling.js Coverage of the Visual Piling Design Space.** An overview of piling.js’ current support for the five dimensions of the visual piling design space.

<table>
<thead>
<tr>
<th>Grouping</th>
</tr>
</thead>
</table>
| **Manual** | Sequential grouping via a drag & drop gesture  
Sequential grouping via multi-selections (multiple mouse clicks while holding down the shift key)  
Parallel grouping via a lasso gesture |
| **Automatic** | Layout-driven grouping via `groupBy('row'), groupBy('column'), or groupBy('grid')`  
Proximity-based grouping via `groupBy('overlap') or groupBy('distance')`  
Similarity-based grouping via `groupBy('category') or groupBy('cluster')` |

<table>
<thead>
<tr>
<th>Arrangement</th>
</tr>
</thead>
</table>
| **Item** | Random offset arrangement  
Orderly rule-based arrangement  
Orderly data-driven arrangement |
| **Pile** | Gridded linear ordering arrangement via `arrangeBy('index')`  
Gridded 2D spreadsheet-like arrangement via `arrangeBy('ij')`  
Precise arrangement via `arrangeBy('xy') or arrangeBy('uv')`  
Precise data-driven arrangement via `arrangeBy('data')` |

<table>
<thead>
<tr>
<th>Previewing</th>
</tr>
</thead>
</table>
| **Partial** | Preview via partial item overlap  
Gallery  
Foreshortened  
Combining  
Indicating |
| **Gallery** | Preview gallery of 2, 3, 4, 6, 8, or 9 thumbnails  
Preview via aggregation or a custom preview renderer  
Preview via aggregation or a custom cover renderer  
Preview via custom preview renderer |

<table>
<thead>
<tr>
<th>Browsing</th>
</tr>
</thead>
</table>
| **In-place** | Full item will appear at the top of the pile upon hovering the associated preview  
Dispersion |
| **Dispersion** | Temporary dispersion into a regular 1D or 2D grid  
Layered |
| **Layered** | Browse a pile in isolation via the context menu  
Hierarchical |
| **Hierarchical** | Nested browsing of sub-piles in isolation via the context menu |

<table>
<thead>
<tr>
<th>Aggregation</th>
</tr>
</thead>
</table>
| **Synthetic** | Summary statistics (e.g., min, max, mean, median, or sum)  
Synthetic |
| **Representative** | Kmeans cluster centroids  
Representative |
| **Simplistic** | Custom aggregator with a preview or cover renderer  
Simplistic |