# Squidy

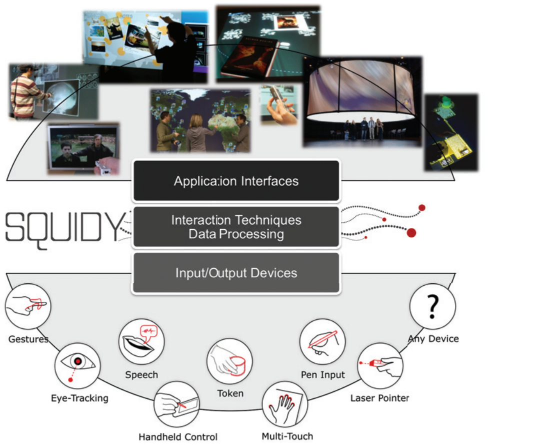
# A Zoomable Design Environment for Natural User Interfaces

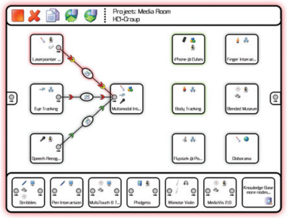
CHI 2009 - Extended Abstracts on Human Factors in Computing Systems, Boston, USA, 2009.

Although some frameworks support the design and development of uncommon input devices and post-WIMP interaction concepts, this keeps a highly challenging task and demands expertise on all layers ranging from hardware prototyping over signal processing to application programming. Furthermore the relevant tools and techniques are spread over diverse heterogeneous frameworks and toolkits. We therefore introduce the interaction library Squidy which eases the design of natural user interfaces by unifying relevant frameworks and toolkits in a common library and providing a central design environment based on high-level visual dataflow programming combined with zoomable user interface concepts. Squidy thereby hides the complexity of the technical implementation from the user by providing a simple visual language and a collection of ready-to-use devices, filters and interaction techniques. However, if more functionality and profound customizations are required, the visual user interface provides them on demand by using the concept of semantic zooming. Thus, the user is able to fit the complexity of the user interface to her current need and knowledge.

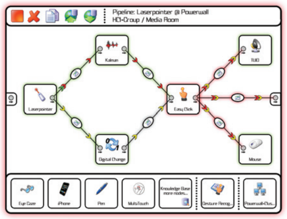
## Key Benefits:

- Supports **interactive design**, configuration and visual management of novel input devices and interaction techniques
- **Rapid prototyping**: offers a simple visual language and a collection of ready-to-use devices and interaction techniques
- **Adjustable complexity**: semantic zooming enables access to advanced functionality on demand (e.g. parameter configuration, documentation, visual debugging, embedded source code)
- **Unifies diverse toolkits**, drivers and frameworks (e.g. for Surface Computing, gestural interfaces, pen input, token interaction, gaze-based input)
- **Supports whole life cycle**: Interactive design, implementation, evaluation & redesign



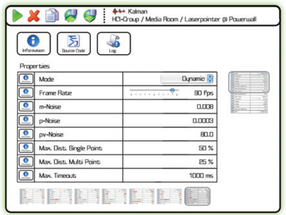


Within a "project view" several pipelines are grouped into logical units representing entire interaction spaces (e.g. Media Room) with diverse interaction devices and techniques. This view gives an overview over the project and supports simultaneous manipulations on multiple pipelines.



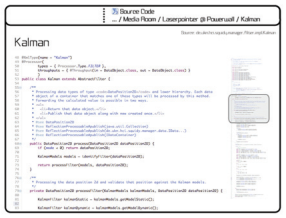
This sample "pipeline view" shows a running pipeline for Laserpointer-Interaction. The pipe-and-filter metaphor offers a simple visual language to define the data flow from source nodes over filter nodes to sink nodes. The color glow indicates the current state of each node or pipe and provides direct feedback about failures and their corresponding impact.

Squidy provides the capability to adjust parameters of a certain node interactively. By using the concept of semantic zooming the node reveals its parameters directly in the context. Changes are applied immediately and affect the running interaction technique. This supports a highly interactive design approach and provides full control of the environment (e.g. for comparative evaluation studies).

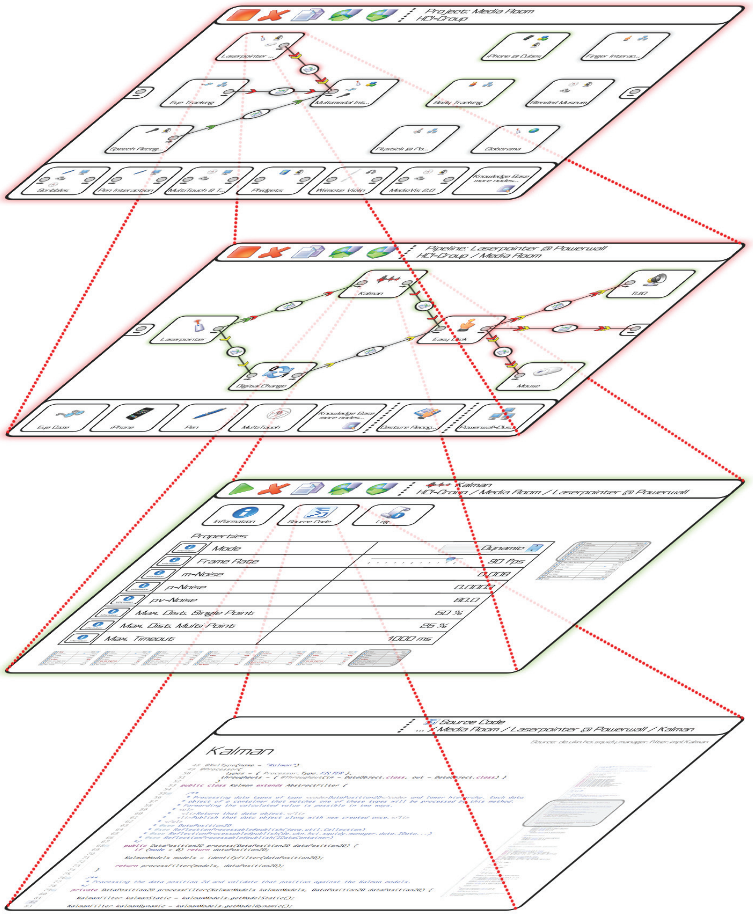


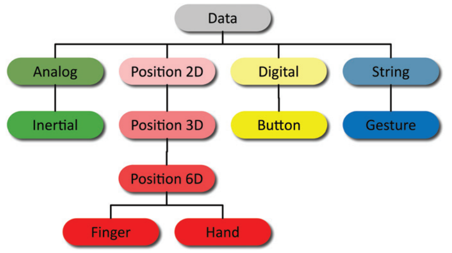
Properties

| | |
|---|---|
| Mode | Dynamic |
| Frame Rate | 90 fps |
| m-Noise | 0.008 |
| p-Noise | 0.0003 |
| pv-Noise | 80.0 |
| Max. Dist. Single Point | 50 % |
| Max. Dist. Multi Point | 25 % |
| Max. Timeout | 1000 ms |



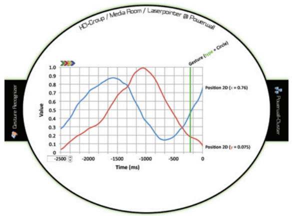
The "source code view" of Squidy grants access to the source code of the corresponding node without the need of switching to a different IDE or rebuilding the application. Users therefore get detailed knowledge about the functionality of the particular node and they are able to directly manipulate this functionality. Modifications are applied as soon as the user zooms out and thus returns to a higher level view.

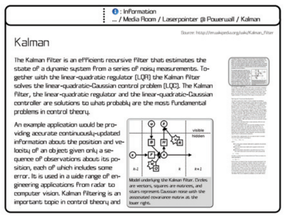




Squidy data type hierarchy based on primitive virtual devices introduced by [Wallace, V. L., The semantics of graphic input devices, SIGGRAPH'76]. The interaction data consists of single instances or compositions of these predefined data types.

In order to improve users' understanding and interpretation of the interaction data, Squidy visualizes the current data flow. Each pipe provides such a data flow visualization which maps the values of the carried data according to its occurrence over time. This approach offers the opportunity to identify unique interaction patterns and provides the possibility for visual debugging at run-time.




Information
.../ Media Room / Laserpointer @ Powerwall / Kalman
Kalman
Model underlying the Kalman Filter. Circles are vectors, squares are matrices, and stars represent Gaussian noise with the associated covariance matrix at the lower right.

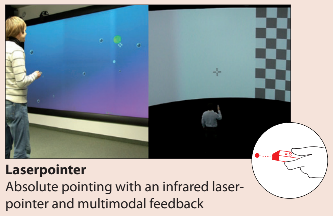
Squidy offers illustrated documentation for each node and also for each node parameter which helps to improve the learnability and understanding of the given functionality and the current parameter setting. The "documentation view" may embed both internal and external content such as articles, images and videos.

# Natural User Interfaces

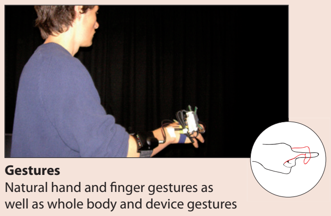
This work is supported by DFG GK-1042 "Explorative Analysis and Visualization of Large Information Spaces" and the project "Interactive Visualization for Gigapixel Displays" supported by the "Information Technology Baden-Württemberg (BW-FIT)" program.

information at your fingertips

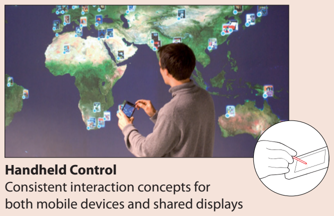
**Multi-Touch & Tokens**
Direct manipulation of visual and physical objects by touch and token interaction



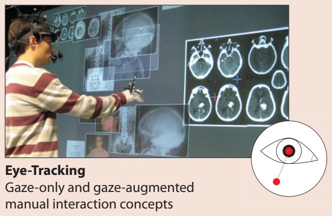
**Laserpointer**
Absolute pointing with an infrared laser-pointer and multimodal feedback



**Gestures**
Natural hand and finger gestures as well as whole body and device gestures



**Handheld Control**
Consistent interaction concepts for both mobile devices and shared displays



**Eye-Tracking**
Gaze-only and gaze-augmented manual interaction concepts

**Multimodal Interaction**
Combination of diverse input and output modes for single and multi-user environments

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