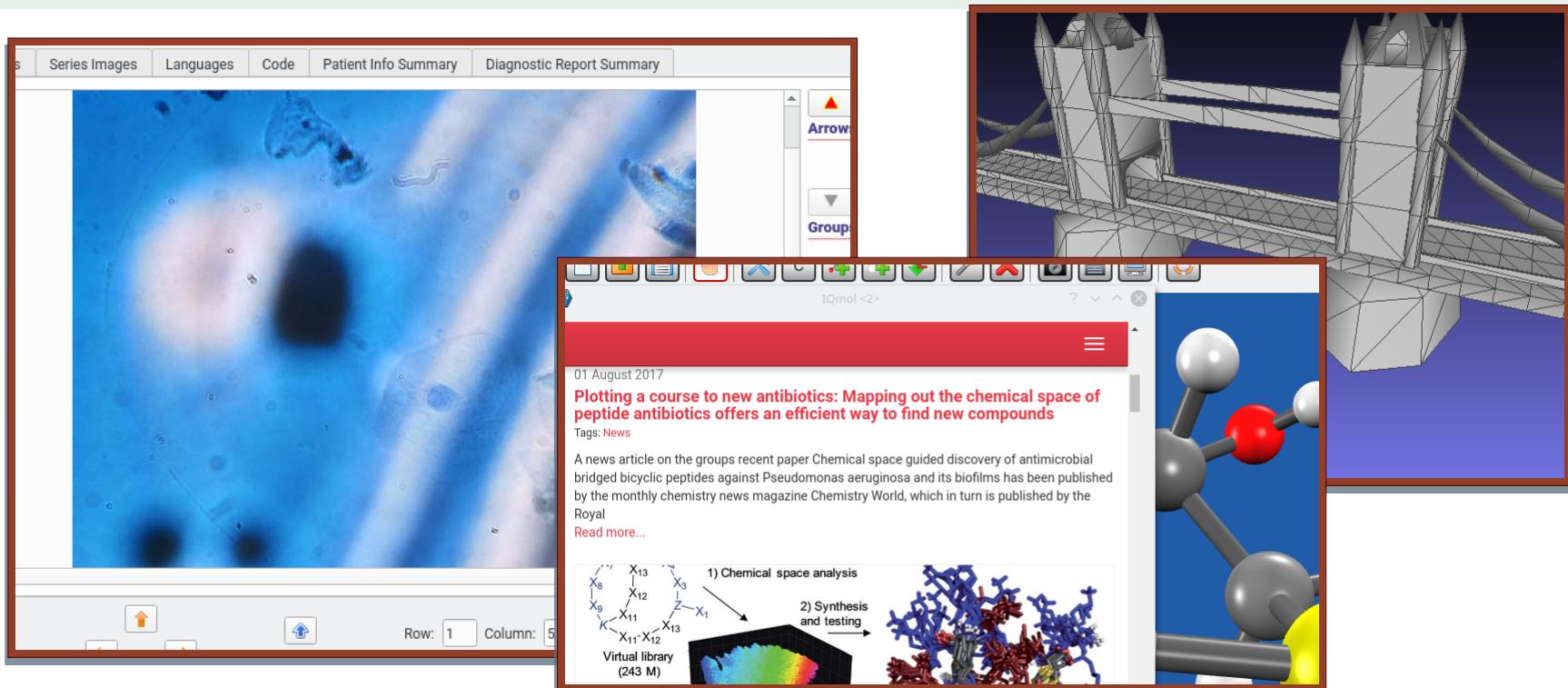


# The NCN/A3R ("NA3")

## Native Application Development Framework



Linguistic Technology Systems

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201-224-5096

# The NCN (Native Cloud/Native) Protocol

## Cloud/Native Components as back-ends for native software

- “Native Cloud/Native” refers to native application front-ends paired with Cloud/Native container instances.
- Share code libraries and data representation across both endpoints.
- Common representation on both server- and client-side streamlines network communications (no need to marshal data between different formats).
- This presentation will focus on NA3’s default Qt implementation, though the technology can be ported to other application frameworks (wxWidgets, XCode, MFC, etc.).

## How Cloud Back-Ends Enhance Native Front Ends

- Cloud Backup; Share data between users; Collaborative Editing
- Persist users’ application state across different computers (home/school/office)
- Upgrade running applications without re-compile

# Application-As-A-Resource (A3R)

## The A3R Application Model

- A3R Applications are self-contained, citable resources which can conform to modern resource documentation standards, such as the Research Object protocol.
- A3R Applications can use Hypergraph-structured metadata to describe data types, procedures, User Interface features, and inter-type relationships (for instance, the relation between data types and the types of GUI components which visualize them).

## A3R Developer Tools

- Hypergraph-based data modeling and serialization.
- Framework for building custom scripting, parsing, and data persistence engines.
- Enhanced support for applications specifically designed to access research data sets.
- Convenient framework for sharing data among applications (to establish inter-application workflows) or between applications and cloud or web services (including leveraging NCN services).

# The Qt Ecosystem

Qt is the most popular native, cross-platform application-development framework.

- ◆ ~1 million active developers
- ◆ Over 5,000 client companies
- ◆ Worldwide “Qt Partners” Ecosystem
- ◆ ~US \$250 million overall market

## However ... Limited Qt Cloud Integration Support

- “Qt Cloud Services” Discontinued in 2016.
- Currently there is no standard model for accessing Cloud services from Qt applications.
- Nor is there a standard Qt-based Cloud/Native container architecture.

# Example Use-Cases

## Inter-Application Networking and Workflow Management

- Export data and instructions between Qt-based applications (slides 6-7).
- Embed document or multi-media viewers inside scientific or dataset applications (slides 18-21).

## Responsive, desktop-style applications for enhanced UX

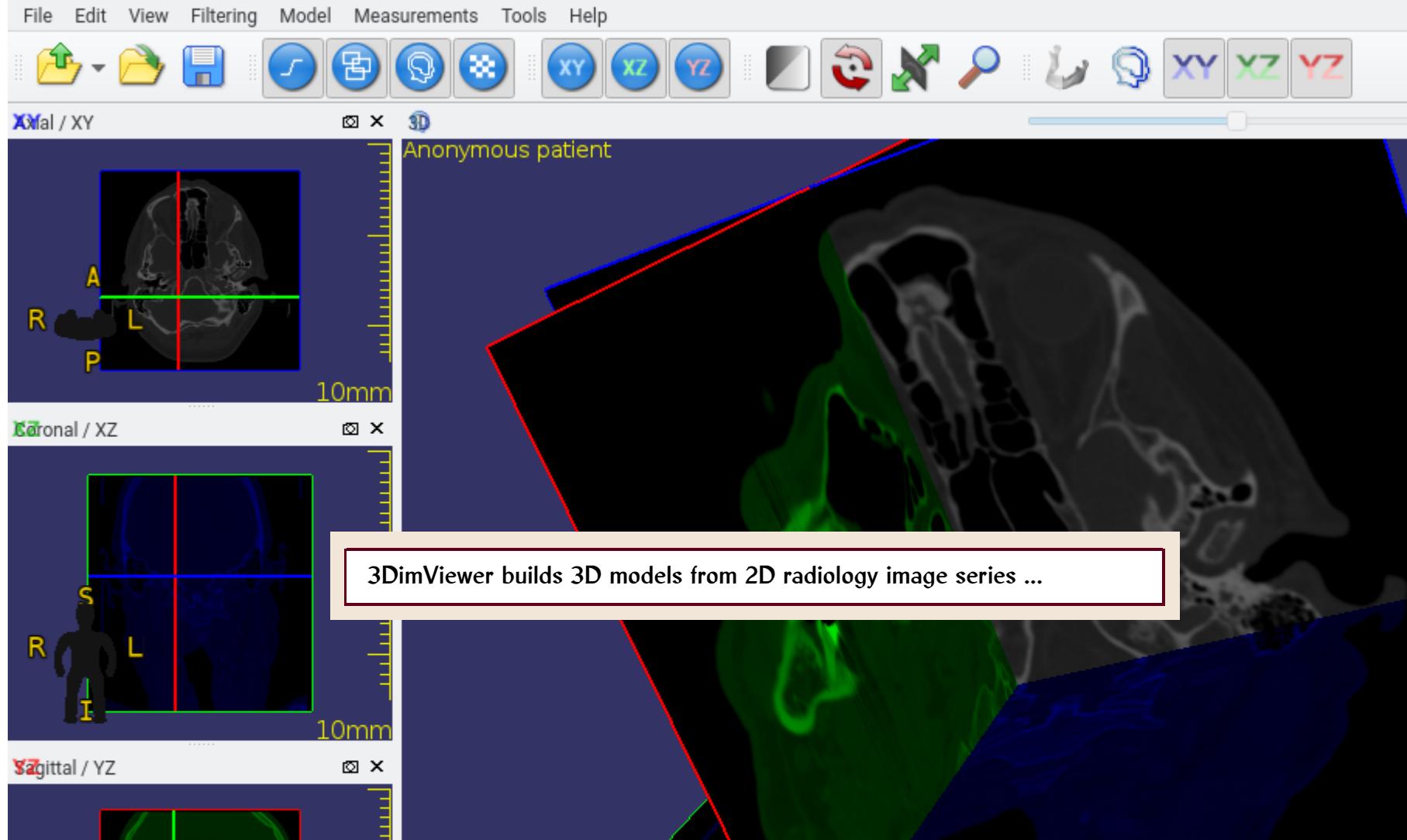
*Native applications offer superior User Experience, leveraging distinct interactive features of desktop GUIs: context menus, dialog boxes, tool tips, Multiple Window Display, dock windows, and so on:*

- Compelling front-ends for e-commerce, Real Estate, VR, etc. (slides 11-17).
- For scientists and researchers, build innovative data-collection instruments as well as interactive Research Object applications (slides 8-10).

# An Example of Inter-Application Networking

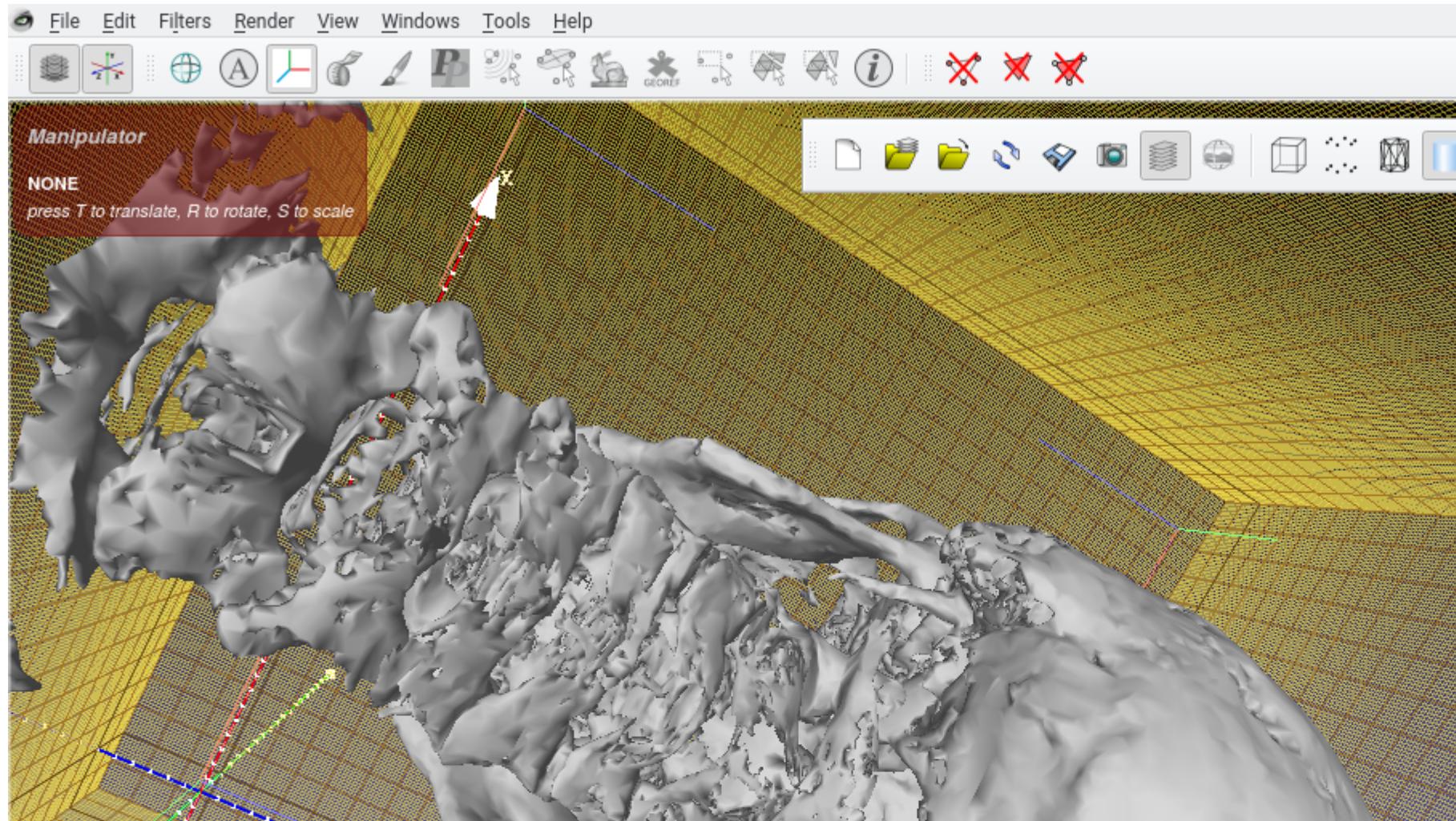
Research S  
Research Slide 2  
Research Slide 3  
Research Slide 4  
Research Slide 5

This slide and the next demonstrate a case-study where inter-application data sharing enhances two applications' capabilities — 3DimViewer, a radiology tool, and MeshLab, a 3D graphics engine.



# 3D Graphics Sent to MeshLab

... Once the 3D tissue sample is constructed by 3DimViewer's algorithms, an A3R inter-application networking protocol (implemented as an extension to both components) allows 3DimViewer to export the model to MeshLab so that it may be studied in a more comprehensive 3D viewing environment.



# A3R Applications as Data Collection Instruments

Research S  
Research Side 2  
Research S  
Research Side 4  
Research Side 5

Forms Web Language Help About

Save Form Open Form Cloud Save Cloud Open Submit Form

Page: 0 Search for: Forwards

Welcome Web

X ? ^ X

Form Outline

Click on a subheading to continue

Patient Information

Chief Complaint

Review of Symptoms

Treatment History

Medical History

Current Medications

Family History

ndp-main-outline <5> ? ^ X

Referring Doctor: Dr. New Test

Referred By (Choose One): Clinical Specialist

Date of Visit: 1/9/16

Please List your Previous Stays

1	Test 2	Sun	Mon	January	Sat
		31	1	February	6
		7	8	March	13
		14	15	April	20
2	Test 1	21	22	May	27
		28	29	June	3
		4	5	July	10

OK Print

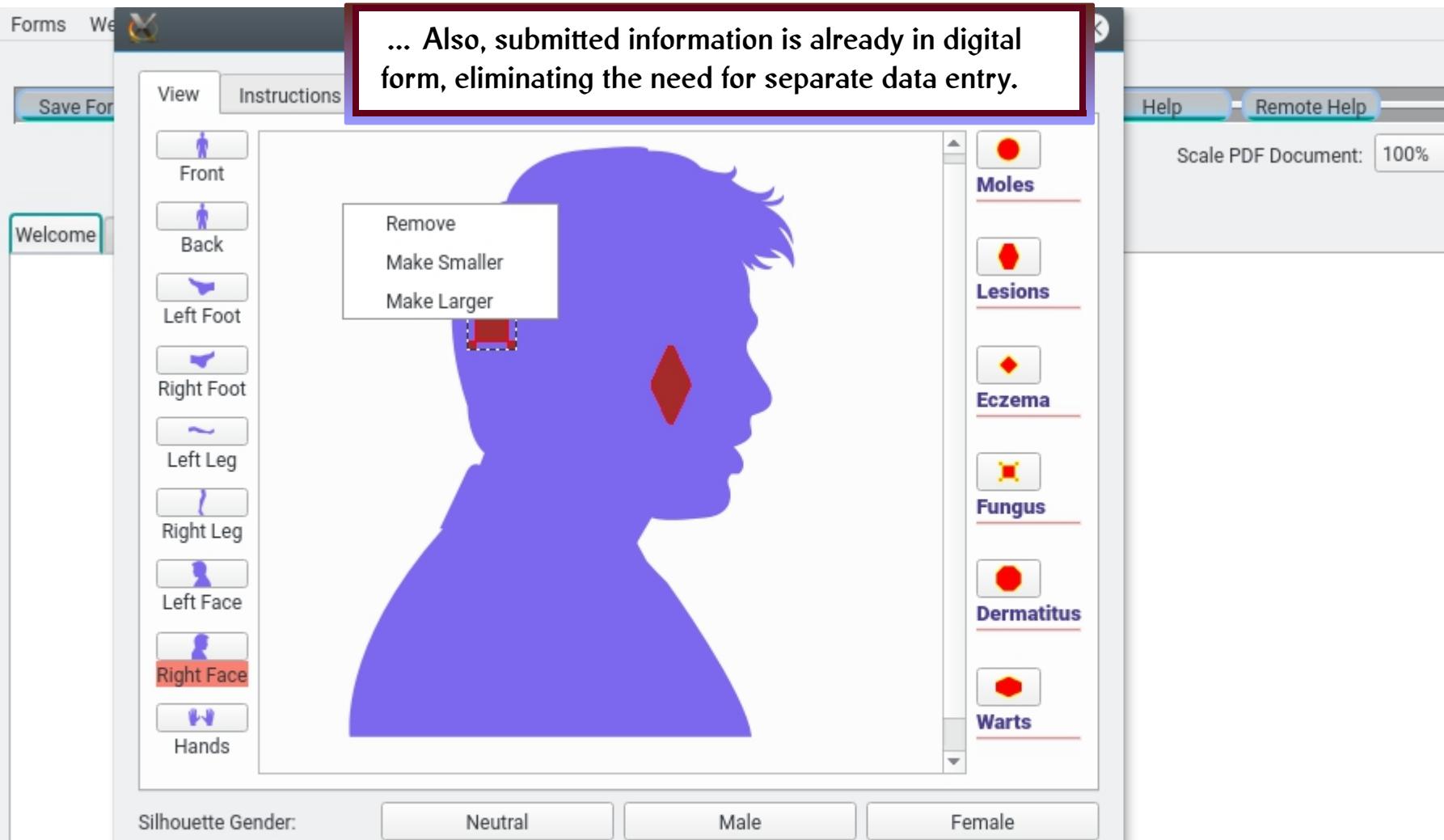
The screenshot shows a software interface for data collection. At the top, there's a menu bar with 'Forms', 'Web', 'Language', 'Help', and 'About'. Below the menu are several buttons: 'Save Form' (green), 'Open Form' (orange), 'Cloud Save' (blue), 'Cloud Open' (yellow), and 'Submit Form' (green). There are also buttons for 'Page: 0', 'Search for:', and 'Forwards'. On the left, there's a sidebar with tabs: 'Welcome' (selected), 'Web', 'X', '?', '^', and 'X'. Below the sidebar is a list of sections: 'Patient Information', 'Chief Complaint', 'Review of Symptoms', 'Treatment History', 'Medical History', 'Current Medications', and 'Family History'. A note says 'Click on a subheading to continue'. A central window titled 'ndp-main-outline <5>' contains fields for 'Referring Doctor' (Dr. New Test) and 'Referred By (Choose One)' (Clinical Specialist). Below these is a date picker set to '1/9/16'. A modal window titled 'Please List your Previous Stays' displays a calendar for January 2018. The calendar shows two entries: '1 Test 2' and '2 Test 1'. The days of the week are labeled 'Sun' through 'Sat'. The month column shows 'January' and the year column shows '2018'. The days of the month are numbered 1 through 31. Buttons at the bottom of the calendar modal are 'OK' and 'Print'.

In medicine and social science, “data collection instruments” (DCIs) refer to surveys, questionnaires, and other tools to get human feedback.

# Qt-Based Interactive Forms

Research Side 1  
Research Side 2  
Research Side 3  
Research Side 4  
Research Side 5

Data Collection Instruments implemented as native desktop applications can have easily navigable, interactive forms that make it simpler for people to provide information ...



# A3R Applications as Research Objects

Complementary to A3R components which facilitate *obtaining* research or experimental data, A3R “Data-Set Applications” are also powerful tools for visualizing and analyzing research findings.

Data-Set Applications are “Research Object Bundles” — combinations of code and data providing access to data sets without the need for external software.

The image shows a screenshot of the A3R application interface. At the top, there is a navigation bar with tabs: View, Instructions, Series Images, Languages, Code, Patient Info Summary, and Diagnostic Report Summary. Below the navigation bar is a toolbar with various icons for image processing and annotations. On the left, there is a vertical stack of small thumbnail images. The main central area displays a histology image of a cell with a prominent purple nucleus. A red arrow points to the right side of the nucleus. To the right of the image, there is a vertical panel containing icons for different annotation tools: Arrows, Comments, Lists, Arcs, and Rulers. At the bottom, there are several control buttons: Silhouette Zoom (with a slider), Image Transforms ..., Annotations Transforms ..., and a Clear button. There are also buttons for Pan, Zoom, and Slide on the left, and Pan, Rotate, and Zoom on the right.

# Native Applications as Interactive Catalogs

E-Commerce  
Slide 1

E-Commerce  
Slide 2

E-Commerce  
Slide 3

E-Commerce  
Slide 4

E-Commerce  
Slide 5

E-Commerce  
Slide 6

E-Commerce  
Slide 7

As a case-study in enhanced User Experience afforded by native applications, consider how static PDF catalogs and brochures can be turbo-charged to engaging, interactive software-based presentations.

The screenshot shows a user interface for a shoe catalog. In the center is a large image of two brown leather sneakers with white soles. A context menu is open over the right shoe, listing options: Detach Image, Detach Noteboook, Detach Description, **Detach Everything** (which is highlighted), Merge Windows, Explore Color Matches ..., View 3D Model ..., Take Screenshot, View Item List, and View Shopping Cart. To the left of the main image is a sidebar containing three smaller thumbnail images of shoes. At the bottom of the screen, there are navigation buttons for item selection (Item: 3), image zoom (Image Zoom: with a slider), and other controls. Below the main image, there are tabs for 'Overview', 'Features', 'Specs', and 'Reviews'. Under the 'Specs' tab, there is a bulleted list: • Leather upper, • Lace-up, • Round toe. To the right of the main image, there is a section titled 'Grand Crosscourt II Sneaker' with a description: 'Sleek and simple, the Grand Crosscourt II sneaker from Cole Haan is the perfect way to add some tailored casual style to your every day look!'. Below this description is a section titled 'Actions:' with two items: • [Add to Cart](#) and • [Explore Colors](#). There are also two small color swatches for the shoe's color options.

# Interactive “Shopping Carts”

Instead of static lists, shopping carts can be multi-dimensional, multiple-window interactive displays.

The screenshot illustrates a multi-dimensional shopping cart interface. At the top, a navigation bar includes "File", "Email", "Events", "APIs", "Web", and "Broadleaf". Below it, a toolbar shows "Page: 0", a search bar, and a zoom level of "100%". A grid of flower images is visible above the main content area.

The interface features two main product windows:

- Window 1 (Left):** Displays a bouquet of purple peonies and greenery. The product details are:

Lily Garden Silk  
Peony Bouquet  
Home Decoration,  
Lilac, 18 Inches  
High

Below the image are tabs for "Overview", "Specs", "Reviews", and "Q & A".
- Window 2 (Right):** Displays a large bouquet of pink hydrangeas. The product details are:

Frosted  
Hydrangea,  
Mauve, 32  
Inches High, 12  
Floral Sprays

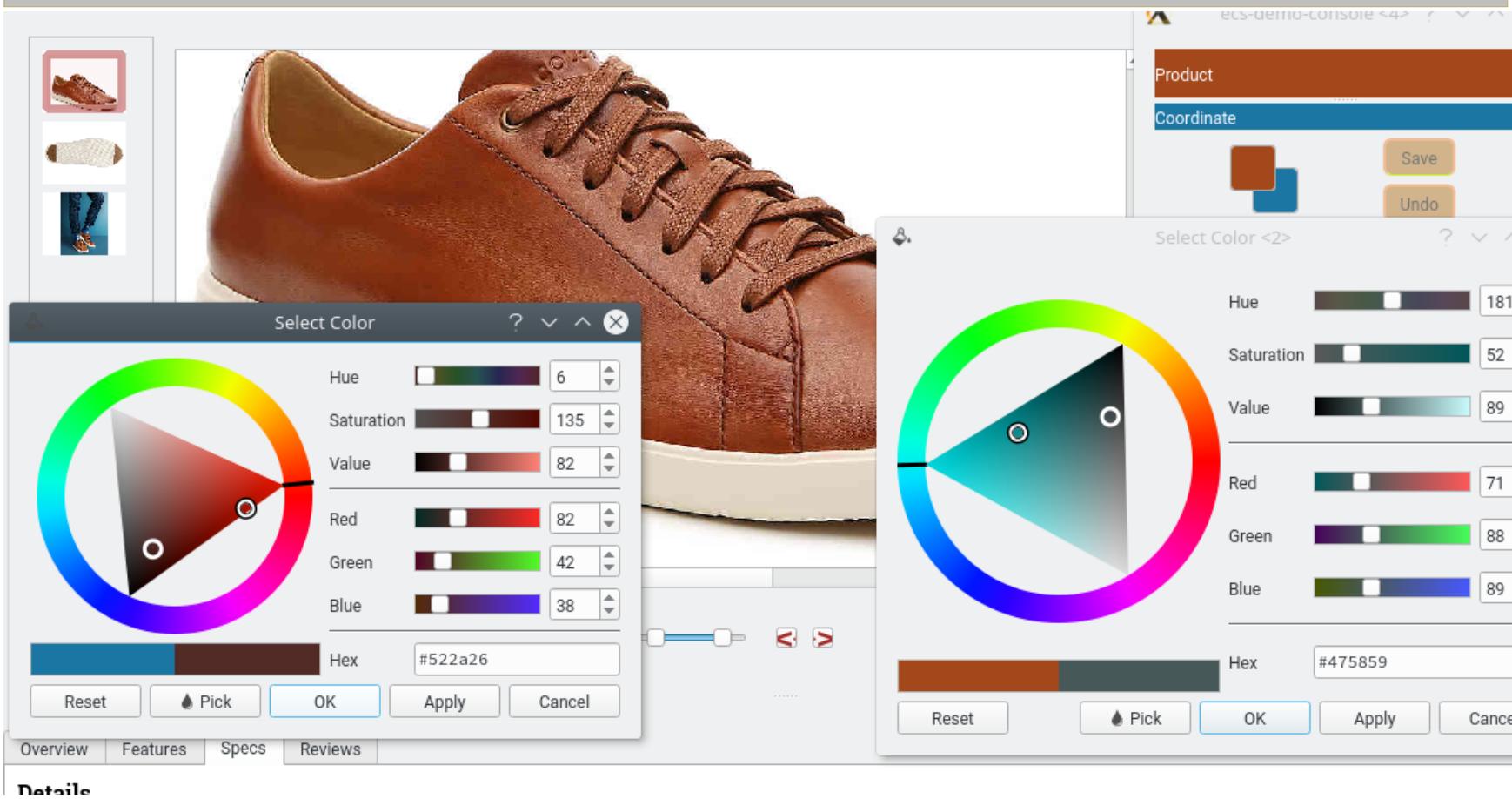
Below the image are tabs for "Overview", "Specs", "Reviews", and "Q & A".

At the bottom of each window are "OK" and "Cancel" buttons.

# Explore Products with Native Software

E-Commerce  
Slide 1  
  
E-Commerce  
Slide 2  
  
E-Commerce  
Slide 3  
  
E-Commerce  
Slide 4  
  
E-Commerce  
Slide 5  
  
E-Commerce  
Slide 6  
  
E-Commerce  
Slide 7

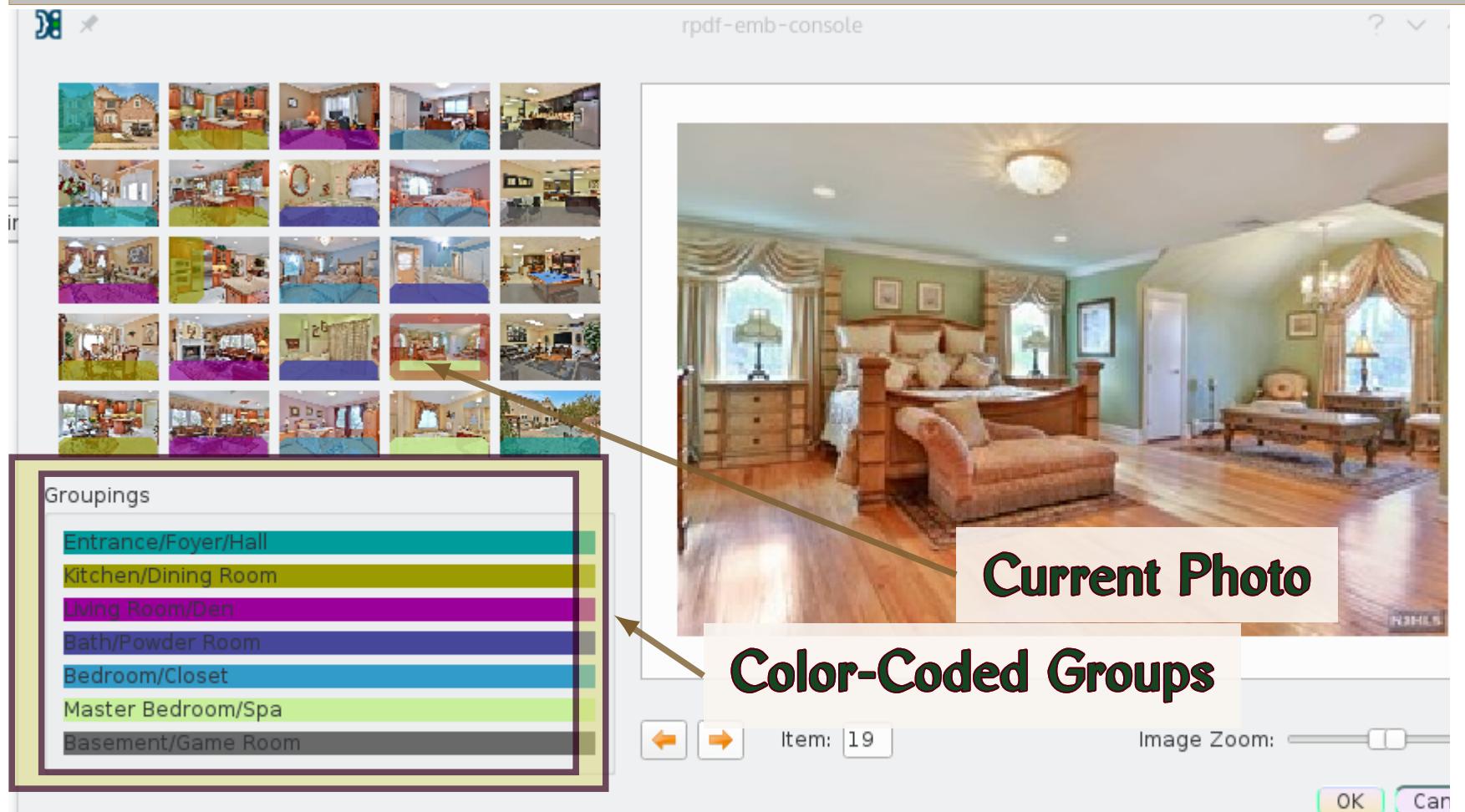
Interactive catalogs allow designers to incorporate many unique features and capabilities of desktop applications, such as using HSV color-wheel controls to explore color coordination while shopping.



# Interactive Real Estate

E-Commerce  
Slide 1  
  
E-Commerce  
Slide 2  
  
E-Commerce  
Slide 3  
  
E-Commerce  
Slide 4  
  
E-Commerce  
Slide 5  
  
E-Commerce  
Slide 6  
  
E-Commerce  
Slide 7

A3R programming can also bring enhanced UX to Real Estate presentations — instead of just groups of photos, properties may be displayed via interactive, multidimensionally-organized, color-coded photo viewers.



The screenshot shows a software application window titled "rpdf-emb-console". On the left, there is a grid of thumbnail images representing different rooms of a house. A specific thumbnail in the bottom row is highlighted with a red border and has a black arrow pointing from it to a larger image on the right. The larger image is a full-screen view of a bright, spacious living room with green walls, large windows, and wooden furniture. Overlaid on this image are two pieces of text: "Current Photo" in a large, bold, dark green font at the bottom right, and "Color-Coded Groups" in a slightly smaller, bold, dark green font directly below it. To the left of the main image, there is a sidebar titled "Groupings" containing a list of room categories, each preceded by a colored square corresponding to the group color in the thumbnail grid. At the bottom of the sidebar, there is a "Close" button. At the very bottom of the application window, there are several control buttons: a left arrow, a right arrow, a text input field containing "Item: 19", a zoom slider labeled "Image Zoom:", and two buttons labeled "OK" and "Cancel".

rpdf-emb-console

Groupings

- Entrance/Foyer/Hall
- Kitchen/Dining Room
- Living Room/Den
- Bath/Powder Room
- Bedroom/Closet
- Master Bedroom/Spa
- Basement/Game Room

Current Photo

Color-Coded Groups

Image Zoom:

OK Cancel

# Photo Viewer Interactive Cues

These slides demonstrate visual cues to aid photo navigation, such as color bands (overlays) that switch from horizontal to vertical indicating which photos have been viewed; and the thumbnail of the current viewed photo marked with a thick colored border (surrounding the thumbnail and any overlays).

The screenshot shows a photo viewer interface with a grid of thumbnails on the left and a large preview image on the right.

- Already Viewed (vertical color band):** A callout points to a thumbnail in the top row where a vertical purple bar overlaps it, indicating it has been viewed.
- Not Yet Viewed (horizontal color band):** A callout points to a thumbnail in the middle row where a horizontal purple bar overlaps it, indicating it has not yet been viewed.
- Current Photo (viewed for the second time):** A callout points to a thumbnail in the bottom row that is surrounded by a thick purple border, indicating it is the current photo being viewed for the second time.

**Groupings:**

- Entrance/Foyer/Hall
- Kitchen/Dining Room
- Living Room/Den
- Bath/Powder Room
- Bedroom/Closet
- Master Bedroom/Spa
- Basement/Game Room

Item: 10

Image Zoom:

# Filtering Photos

Another feature which may be conveniently implemented in A3R-style photo viewers is a filtering option, which — given a collection of pictures classified into several groups — allows users to show or hide photos based on the group they belong to (note the check-box buttons on the group listing).

The screenshot shows a photo viewer interface with a sidebar of thumbnail images and a main view showing a living room. The sidebar includes a 'Groupings' section with several filter options.

**Visible Groups:** Entrance/Foyer/Hall (checked), Living Room/Den (checked), Bedroom/Closet (checked), Master Bedroom/Spa (checked). These are highlighted with a green oval.

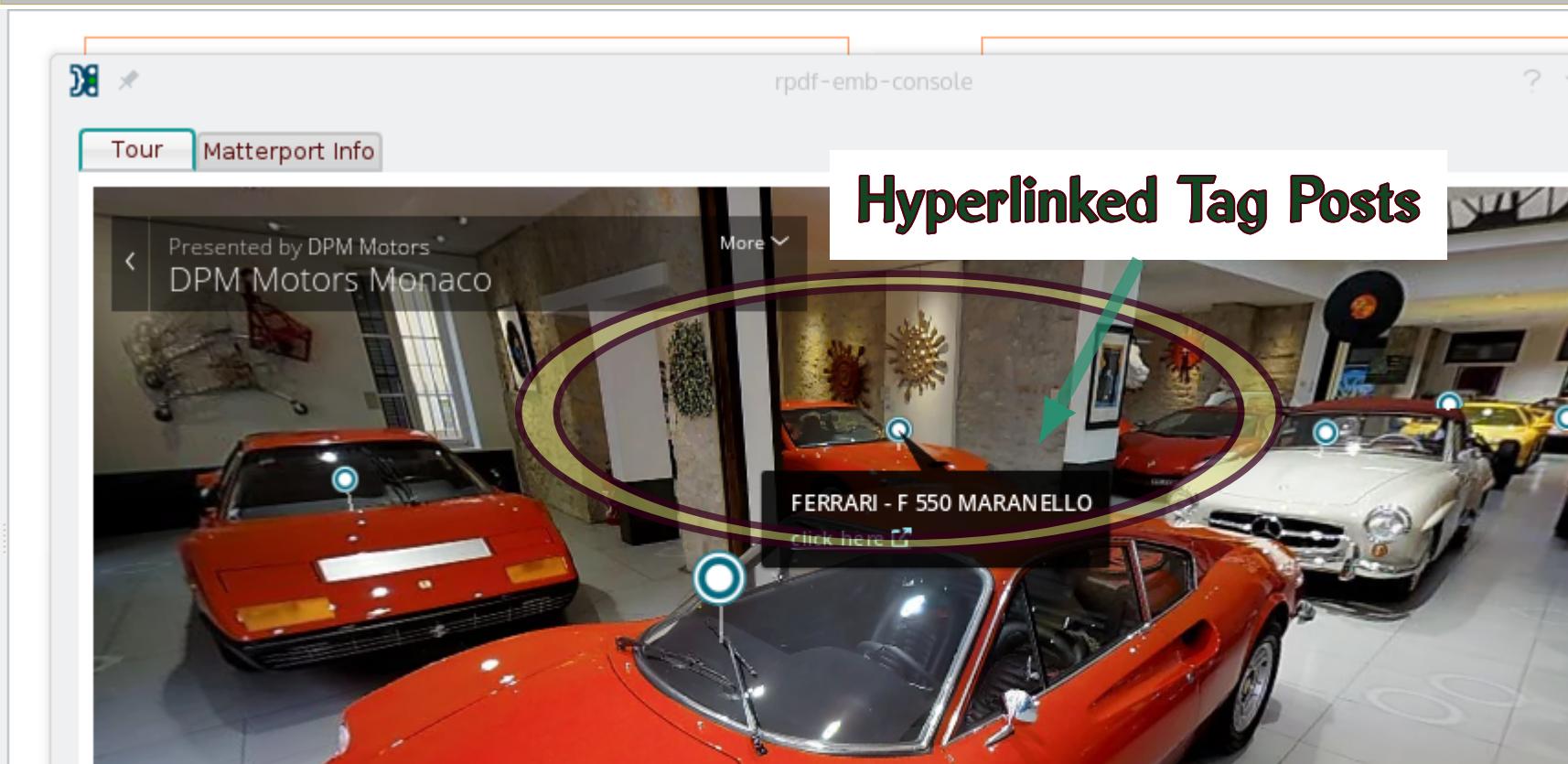
**Check Boxes:** Kitchen/Dining Room, Bath/Powder Room, Basement/Game Room. The 'Bath/Powder Room' checkbox has a red arrow pointing to it.

**Hidden Groups:** Basement/Game Room. This group is circled in red.

Below the sidebar, there are navigation arrows, an 'Item: 3' indicator, an 'Image Zoom:' slider, and 'OK' and 'Cancel' buttons.

# Interactive VR: Hyperlinked Tag Posts

Another emerging technology, relevant to both e-Commerce and Real Estate, is the use of Panoramic Photography to create immersive Virtual Reality scenes. Panorama-Photography-based VR engines, like Matterport, allow “tag posts” with embedded hyperlinks, which in a native-application context become channels of communication between the VR renderer and the host application. The full capabilities of this interactive modality — combining VR with clickable links and text “bubbles” — can only be fully realized via Virtual Reality engines (such as WebGL) embedded in native software.



# A3R Document Viewers

Publishing  
1  
Publishing Slide  
2  
Publishing Slide  
3  
Publishing Slide  
4

A3R applications may embed viewers for document formats such as e-Pub, HTML, and PDF; then supplement conventional publications with special components customized for individual manuscripts — here, a widget allowing readers to visually explore patterns in classical Indian music.

The screenshot shows a digital journal interface. At the top, there are three icons: a gear, a book, and a person reading. Below them are links for 'References', 'Library', and 'Reading'. A navigation bar includes 'HTML Source', 'Lisp', 'CSS', and 'XML'. A large red rectangular area covers the main content area. Below it, a link reads 'Read article view'. At the bottom, there's a small icon of a person sitting at a desk.

## ANTHROPOLOGY AND HUMANISM

[Explore this journal >](#)

### Ethnographer as Apprentice: Embodying omusical Knowledge in South India

da Weidman

Published: 26 December 2012 [Full publication history](#)

The screenshot shows a 'Tala' pattern viewer. At the top, a dropdown menu says 'Display Tala Types: Jhoomra/Dhamar (14 beats)'. Below it is a large rectangular grid divided into 14 columns. The first seven columns are highlighted in red, and the next seven are in purple. Below the grid is a horizontal slider labeled 'Patterns' with 'Pattern 1 (3-4-3-4)' on the left and 'Pattern 2 ( )' on the right. A file path 'File /extension/ScignSeer/articles/svg/tala.svg' is shown below the slider. At the bottom right is a 'Proceed' button.

Volume 37, Issue 2  
December 2012  
Pages 214-235



# A3R Document Viewers as Embedded Components

Document Viewers may also be embedded in host applications which provide domain-specific visualization capabilities. For example, chemistry papers might be viewed within IQmol (a Qt-based program for molecular visualization and physical/chemical analysis) via an A3R document-viewer plugin.

The image shows a software application window with a menu bar at the top containing: Display, Build, Calculation, SONIC, and Help. Below the menu is a toolbar with various icons. On the left, there's a sidebar with a 'Springer' logo and search fields for 'Search' and 'Book'. The main area displays a 3D ball-and-stick model of the amino acid cysteine, with its characteristic sulfur atom highlighted in yellow. To the right of the molecule, a search results window is open, showing a list of items under the 'SONIC' tab. The first item in the list is 'Springer Keyword Search: Cysteine', followed by 'Springer Web Search Home' and 'Search Saved Articles'. At the bottom of the screen, there's a navigation bar with icons for back, forward, and search.

Display Build Calculation SONIC Help

Configure  
Select All  
Reperceive Bonds  
Duplicate Geometry  
Atomic Charges  
Remove

SONIC ► Springer Keyword Search: Cysteine  
Springer Web Search Home  
Search Saved Articles

Springer

Search Book

Cysteine Proteases of Pathogenic Organisms

Robinson, M. W. (Ed), Dalton, J. P. (Ed) (2011)  
Cysteine proteases expressed by pathogenic organisms play key roles in virulence including host

[www.springer.com/gp/search?query=cysteine&submit=Submit](http://www.springer.com/gp/search?query=cysteine&submit=Submit)

# Document Viewers Augmented With APIs

Publishing  
1  
Publishing Slide  
2  
Publishing  
3  
Publishing Slide  
4

Another strategy for interactive publications is linking documents with APIs maintained publishers, or by cultural or educational institutions.

View Instructions

As an example, documents mentioning artifacts held in a museum can provide features to view more information about those museum-pieces through the host institution's API.



**MEDAL**

 Click the icon to save

This is a **Medal**. We acquired it in 1920. It is a part of the **Product Development** department.

Cite this object as

Medal; bronze; 1920-3

Row:

0

Column:

0

# Embedded Multimedia

Publishing  
1  
Publishing Slide  
2  
Publishing Slide  
3  
Publishing  
4

Custom-built A3R document viewers can provide convenient access to multimedia content embedded in or linked to documents — including audio files, videos, and 3D graphics scenes or models.

*Ailurus fulgens styani* (also known as *a. f. refulgens*): Only found in China (in the Hengduan Mountains in Sichuan and the East Nujiang River of Yunnan Province) and northern Myanmar.

The head and body length of red pandas averages 56 to 63 cm (22 to 25 in), and their tails about 37 to 47 cm (15 to 19 in).



## Behavior

Red pandas are generally solitary, but there are a couple of exceptions. They develop extended associations with their mothers that last through the breeding season.



In terms of territoriality, red pandas tend to have overlapping territories with other. This may be due to the fact that they search for their food in different areas, which may be patchily distributed.

[ark.org/red\\_panda/about-the-red-panda/](http://ark.org/red_panda/about-the-red-panda/)

so they e annual

They each das may be effect the

ARKIVE  
www.arkive.org

Moving images copyright  
© BBC Natural History Unit

Sound recordings copyright  
© BBC Natural History Unit  
© Natural FX

Restart Pause Play

URL file:///ext\_root/videos/a.mp4

OK Proceed Cancel

February 3, 2020 21 / 22

# Thank You!

Thanks

Please contact Linguistic Technology Systems for more information about NA3 or other Software Development and Software Language Engineering solutions.

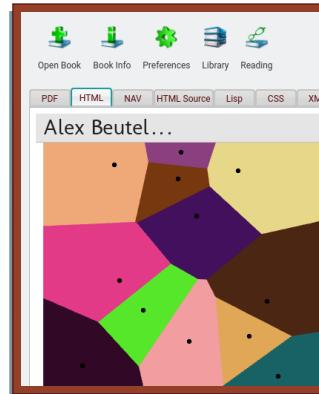
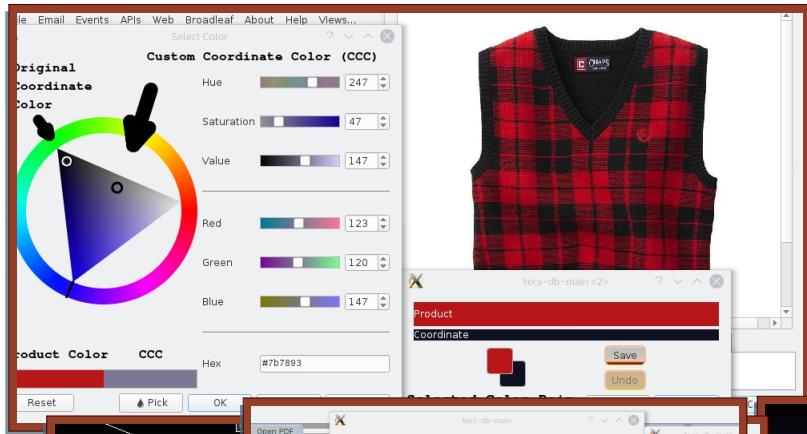


Figure 2 The Voronoi Diagram of the set of Melbourne's inner city train stations.

It should also be noted that this account aims to represent space partitioning at a cognitive rather than at a physical level. What this means is that *at* will not be

