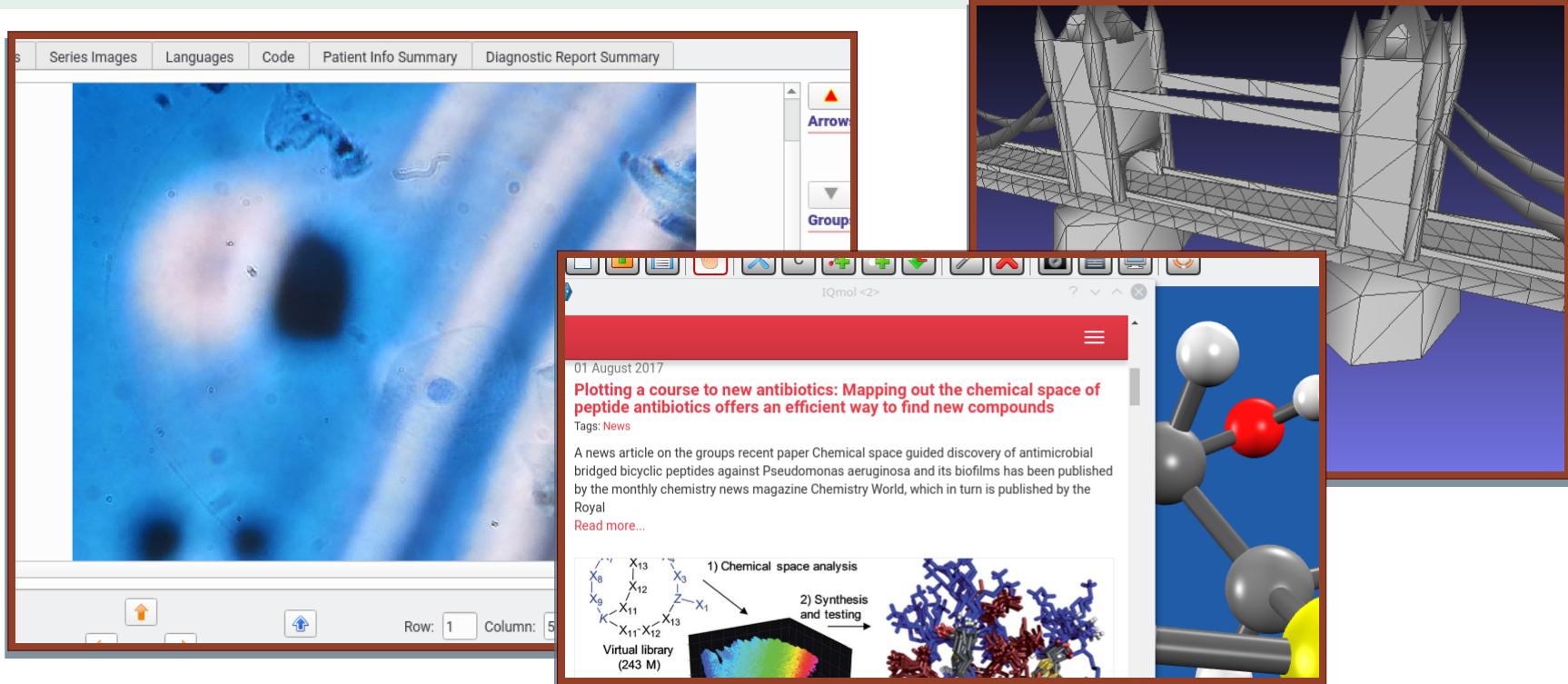


# The NCN/A3R ("NA3")

## Native Application Development Framework



Linguistic Technology Systems  
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# Team Members

**Lead Software Architect** Nathaniel Christen, Doctoral Candidate, University of Ottawa. Specializations: C++, Programming Language Implementation, Cognitive and Computational Linguistics, Scientific Computing, Philosophy of Science, Digital Humanities.

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**Medical Imaging and Data Communications Consultant** Alan H. Rowberg, M.D., formerly RIS/PACS Manager at Northwest Hospital; Co-Developer of DICOM protocol formerly Co-Chair of DICOM Standards Committee.

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**Company Founder and CEO** Amy Neustein, Ph.D., Editor-in-Chief of the *International Journal of Speech Technology*; Editor of De Gruyter Series in Text Mining in Medicine and Health Care; Editor of SpringerBriefs in Speech Technology; Author/Editor of 11 academic books on subjects ranging from natural language processing, speech recognition, text mining, speech and automata, forensic speaker recognition, cyber-physical systems, to studies of gender bias in the family courts and child abuse cover ups in close-knit religious communities and by the institutions that serve them.

# The NCN (Native Cloud/Native) Protocol

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

- Our “Native Cloud/Native” protocol refers to native application front-ends paired with Cloud/Native (back-end) container instances.
- Code libraries and data representation may be shared across both endpoints.
- Common representation on both server- and client-side streamlines network communications (no need to marshal data between different formats).
- The NA3 technology can be ported to other application frameworks apart from Qt (wxWidgets, XCode, MFC, etc.).
  - Note: This presentation will focus on NA3’s default Qt implementation.

## How Cloud Back-Ends Enhance Native Front Ends

- Cloud Backup     ● Share Data between Users     ● Collaborative Editing
- Maintain users’ application state across different computers (home/school/office)
- Upgrade running applications without needing to re-compile

# The Qt Ecosystem and the Limitations of Qt in the Cloud

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 \$25 billion 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.

# “Application-As-A-Resource” (A3R)

## The A3R Application Model

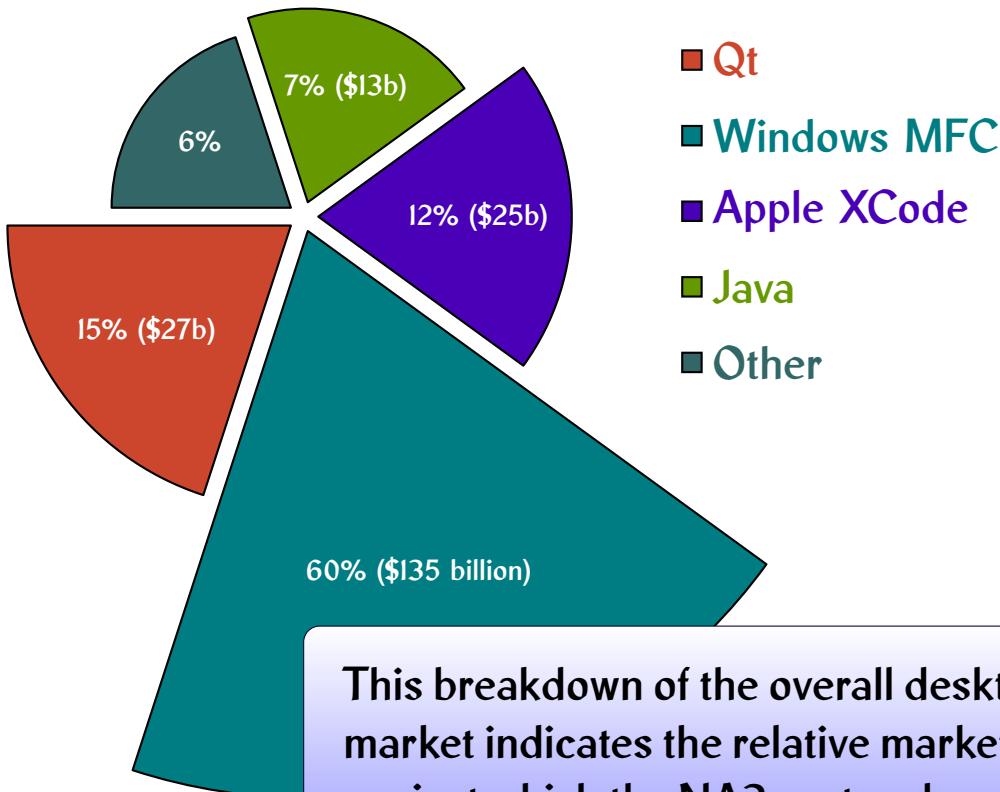
- A3R Applications are self-contained, citable resources which can conform to modern resource documentation standards, such as the Research Object protocol.
- A3R Applications can use Hypergraph-structured metadata to describe data types, procedures, User Interface features, and inter-type relationships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

# Overview of the Software Development Market

This slide offers a rough breakdown of the software development market, (estimated at \$350 Billion), restricted to desktop software (roughly one-half the total market), including both cross-platform and single-platform solutions.



Taking the Qt implementations of the NCN and A3R protocols as a prototype, analogous versions may be built targeting other popular software-development platforms (see next slide for a more detailed outline).

This breakdown of the overall desktop application-development market indicates the relative market share of different platforms against which the NA3 protocols may be implemented.

# NA3 In Different Software Ecosystems

## Potential NA3 Markets

**Windows MFC** ( \$135b market size) A3R can be implemented in C++/CLI, building off of a generic-C++ version using the C++ Standard Library in place of Qt-specific data structures.

**Apple XCode** ( \$25b market size) Apple Operating Systems are based on Linux, so a Linux-oriented A3R implementation can form the basis of an XCode version. This XCode implementation would also be built around the C++ Standard Library.

**JavaFX** ( \$12.5b market size) The Java programming language provides the most widely used cross-platform application development framework outside of Qt. It is feasible to port C++ A3R implementations to Java. The core of this re-implementation would involve designing a Java Hypergraph Library compatible with the A3R serialization and Interface Definition protocol.

**Workflow Management** ( \$10b market size) A3R plugins can be added to new or existing applications to support inter-application networking, allowing multiple applications to be unified into workflow-management systems.

# 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

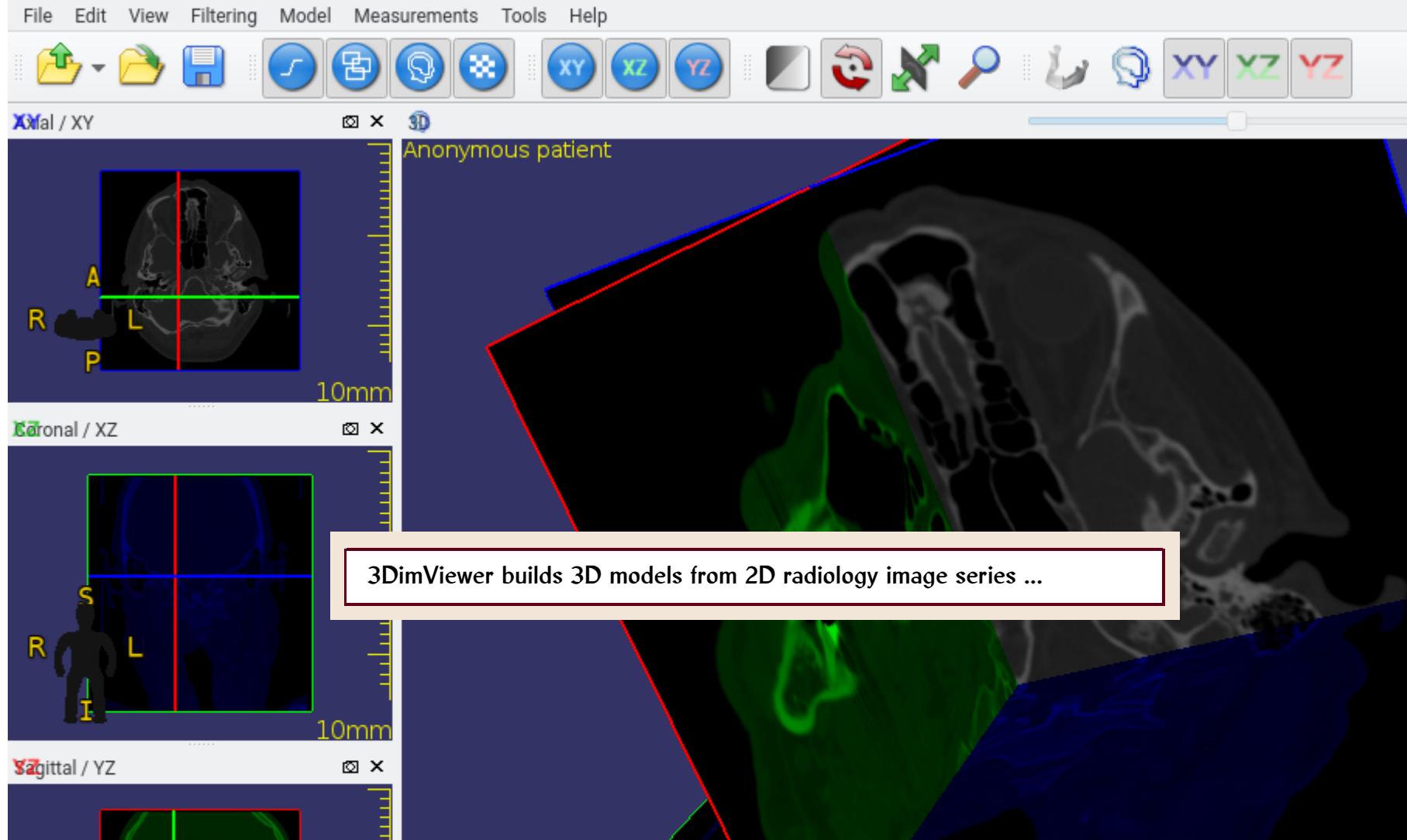
*Native applications offer superior User Experience, leveraging distinct interactive features of desktop GUIs: context menus, dialog boxes, tool tips, Multiple Window Display, dock windows, and so on:*

- Compelling front-ends for e-commerce (Note: “46% of global online retail orders happen on desktop”, source: lefronic.com), 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

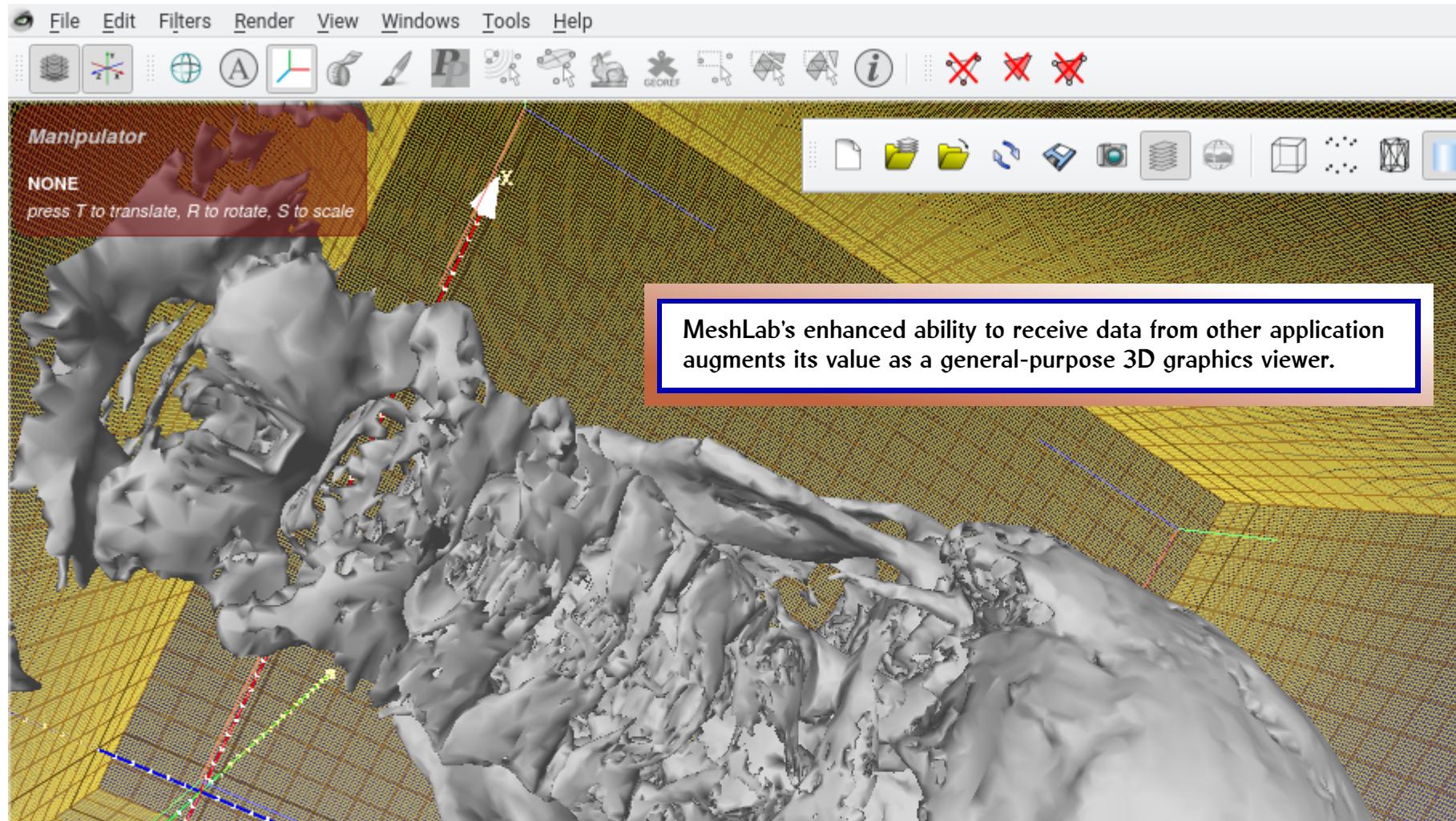
Research S  
Research Slide 2  
Research Slide 3  
Research Slide 4  
Research Slide 5

This slide and the next demonstrate a case-study where inter-application data sharing enhances the capabilities of two applications: 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 applications) 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 ? ^ × 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> ? ^ ×

Referring Doctor: Dr. New Test

Referred By (Choose One): Clinical Specialist

Date of Visit 1/9/16 < January 2018 >

Please List your Previous Stays

Sun	Mon	Tue	Wed	Thu	Fri	Sat
31	1					
7	8					6
14	15					13
21	22					20
28	29					27
4	5					3

OK Print

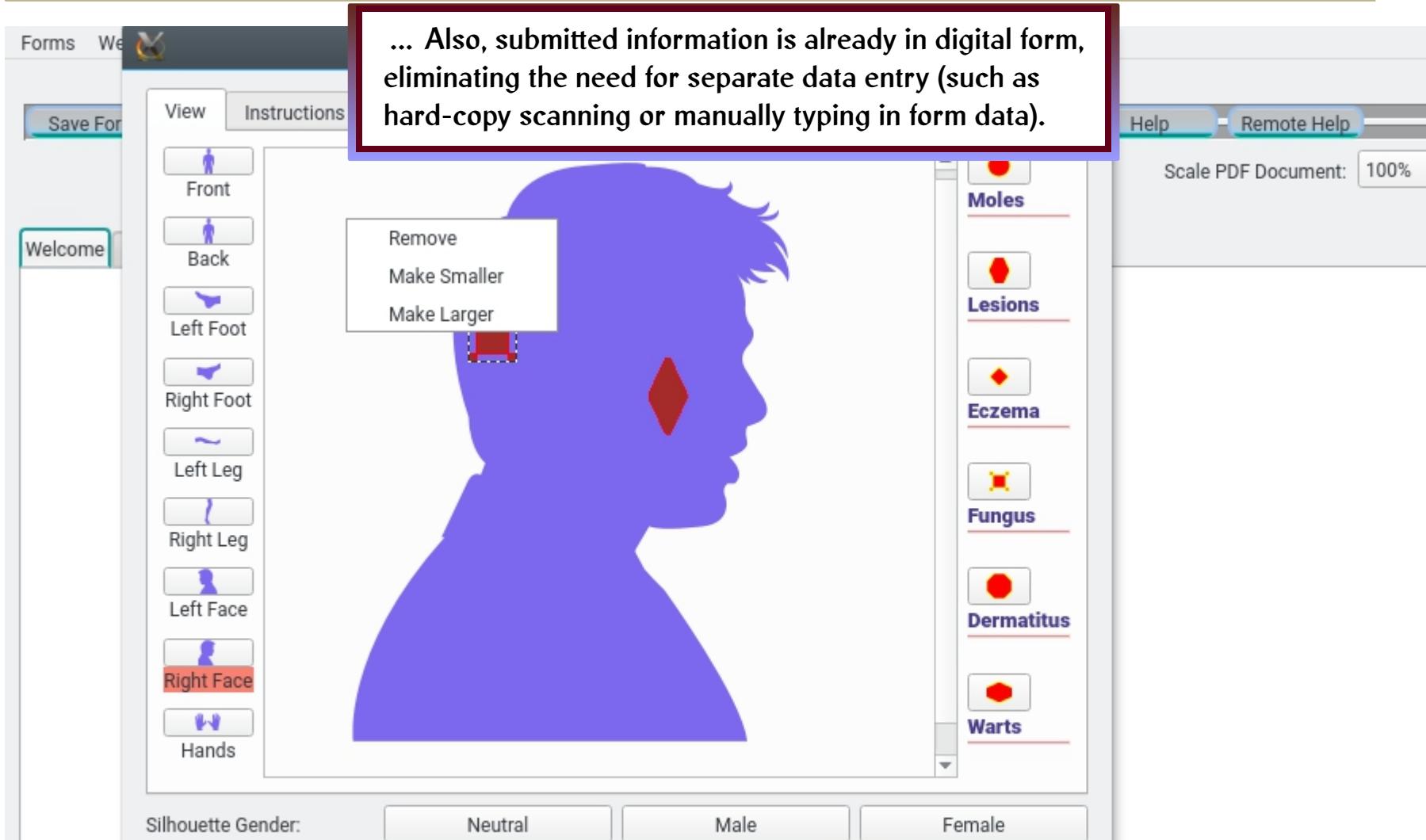
January  
February  
March  
April  
May  
June  
July  
August  
September  
October

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

# Qt-Based Interactive Forms

Research S  
Research Side 2  
Research Slide 3  
Research S  
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 dependencies.

The interface shows a central image of a cell with a red arrow pointing to its nucleus. To the left is a vertical stack of small thumbnail images. To the right are toolbars for annotations: Arrows, Comments, Lists, Arcs, and Rulers. At the bottom are controls for Silhouette Zoom, Image Transforms, Annotations Transforms, and various navigation buttons like Pan, Zoom, and Rotate.

# 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 into engaging, interactive software-based presentations.

The screenshot shows a native application interface for a product 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 with three smaller thumbnail images of different shoes. At the bottom left, there are navigation icons for up, down, and left-right. Below the main image, there are controls for 'Item: 3' and 'Image Zoom'. At the very bottom, there are tabs for 'Overview', 'Features', 'Specs', and 'Reviews', with 'Overview' being the active tab. To the right of the main image, there is a detailed product description for the 'Grand Crosscourt II Sneaker'.

**Grand Crosscourt II Sneaker**

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!

**Actions:**

- [Add to Cart](#)
- [Explore Colors](#)

Overview Features Specs Reviews

- Leather upper
- Lace-up
- Round toe

# Interactive Shopping Carts

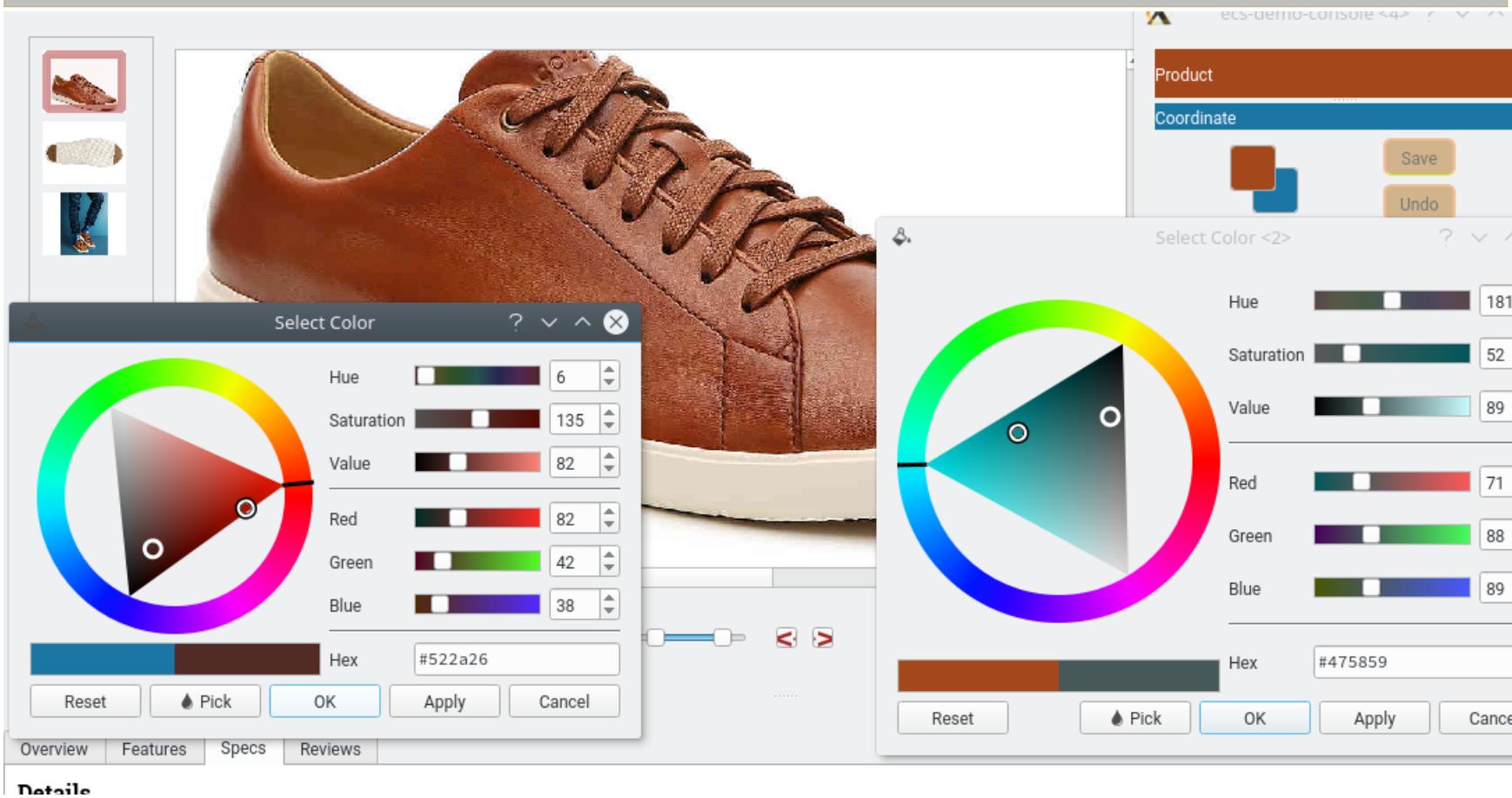
Instead of static lists, shopping carts can be made into multi-dimensional, multiple-window interactive displays.

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 are search and filter controls: Page: 0, Search for:, and a zoom setting at 100%. The main area features two overlapping windows, each titled 'tecs-db-main <2>' and 'tecs-db-main <3>'.  
The left window displays a purple peony bouquet with the following details:  
Lily Garden Silk Peony Bouquet Home Decoration, Lilac, 18 Inches High  
The right window displays a large hydrangea arrangement with the following details:  
Frosted Hydrangea, Mauve, 32 Inches High, 12 Floral Sprays  
Both windows have tabs for Overview, Specs, Reviews, and Q & A, and buttons for OK and Cancel.

# 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  
  
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Slide 4  
  
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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 can be displayed via interactive, multi-dimensionally organized, color-coded photo viewers.

The screenshot shows a user interface for viewing real estate photographs. On the left, there is a grid of thumbnail images representing different rooms and exterior views of a property. A specific thumbnail in the bottom row is highlighted with a red border and has an arrow pointing to it from a callout box labeled "Color-Coded Groups". To the right of the grid is a large image of a master bedroom with green walls, a wooden bed, and a chaise lounge. This image is enclosed in a white box with the text "Current Photo". At the bottom of the screen, there is a navigation bar with arrows for navigating through the photos, the text "Item: 19", and a "Image Zoom:" slider. On the far right, there are "OK" and "Cancel" buttons. On the far left, there is a sidebar titled "Groupings" containing a list of room categories, each associated with a colored bar: Entrance/Foyer/Hall (teal), Kitchen/Dining Room (yellow-green), Living Room/Den (purple), Bath/Powder Room (blue), Bedroom/Closet (teal), Master Bedroom/Spa (light green), and Basement/Game Room (grey).

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

Item: 19

Image Zoom:

OK Cancel

# Photo Viewer Interactive Cues

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

The screenshot shows a photo viewer interface with a grid of thumbnail images. A large, detailed image of a living room is displayed on the right side of the screen. On the left, there is a sidebar with a list of 'Groupings' and a navigation bar at the bottom.

- Already Viewed (vertical color band):** A callout points to a thumbnail in the second row, third column, which has a thick vertical purple border around it.
- Not Yet Viewed (horizontal color band):** Another callout points to a thumbnail in the fourth row, fifth column, which has a thin horizontal purple border around it.
- Current Photo (viewed for the second time):** A callout points to the same thumbnail in the second row, third column, which now has a thick horizontal purple border around it, indicating it is the current photo being viewed.

**Groupings:**

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

**Navigation:**

- Left arrow: <
- Right arrow: >
- Item: 10
- Image Zoom: [Slider]

# 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 a list of room categories and a 'Check Boxes' section below it.

**Visible Groups:** Entrance/Foyer/Hall, Living Room/Den, Bedroom/Closet, Master Bedroom/Spa.

**Check Boxes:** Kitchen/Dining Room, Bath/Powder Room, Basement/Game Room.

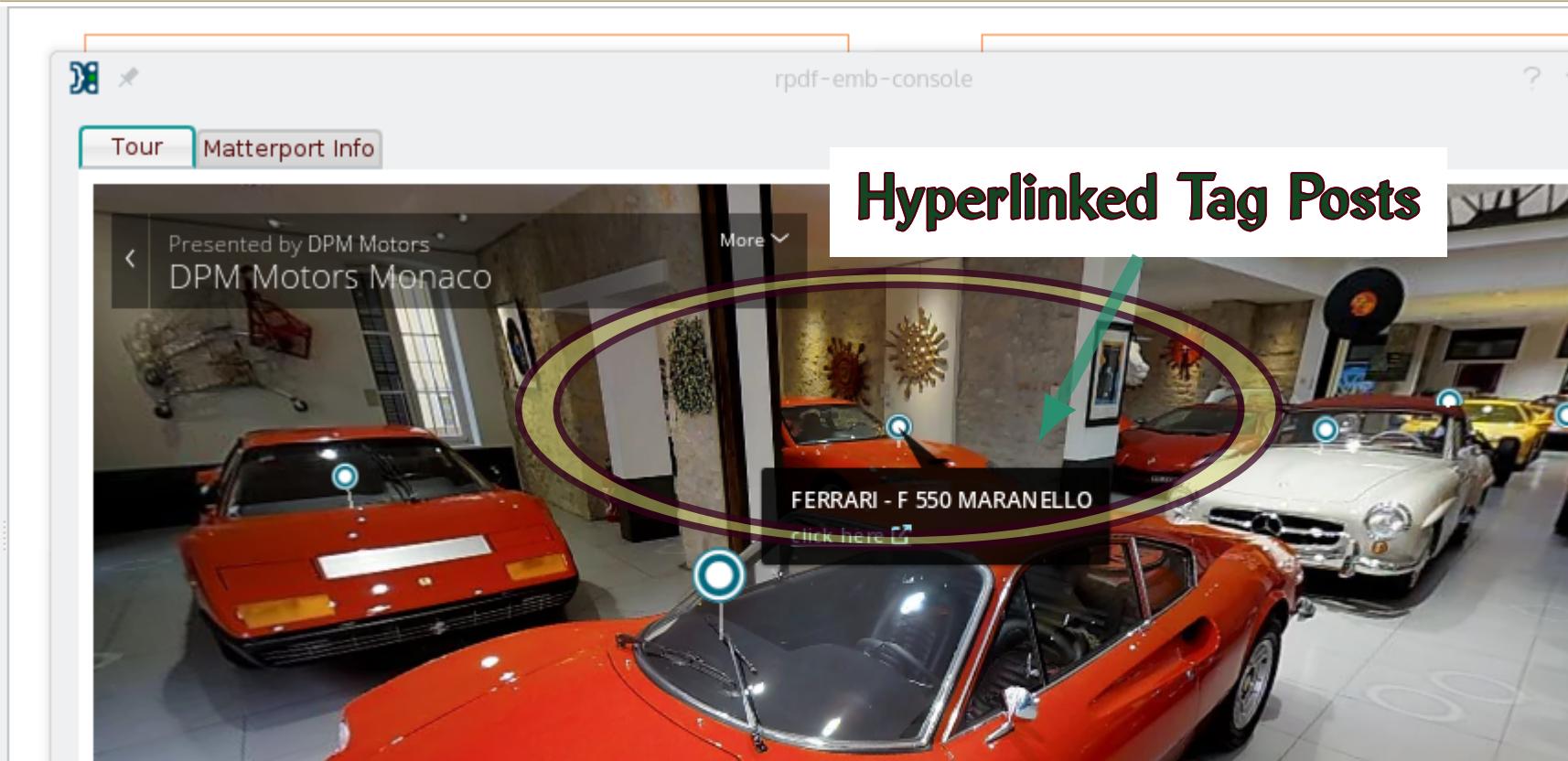
**Hidden Groups:** (None are visible)

Item: 3      Image Zoom: [Slider]      OK

Annotations: A green oval highlights 'Entrance/Foyer/Hall' in the 'Visible Groups' list. A red oval highlights 'Basement/Game Room' in the 'Check Boxes' list. A red arrow points from the 'Check Boxes' list to the 'Hidden Groups' label.

# 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

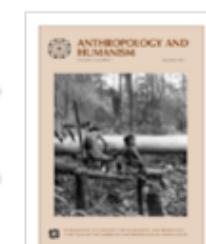
A3R applications may embed viewers for document formats such as e-Pub, HTML, and PDF; then supplement conventional publications with special components customized for individual manuscripts: e.g. (as in this case), a widget allowing readers to visually explore patterns in classical Indian music.

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 at the bottom includes 'HTML Source', 'Lisp', 'CSS', and 'XML'. The main content area features the title 'ANTHROPOLOGY AND HUMANISM' in large brown letters. Below it is a blue link 'Explore this journal >'. On the left side, there is a sidebar with a red background containing the text 'Read article view' and a small orange icon.

This screenshot shows a specialized A3R viewer window. At the top, it says 'Display Tala Types: Jhoomra/Dhamar (14 beats)'. Below this is a diagram consisting of two horizontal rows of colored rectangles. The top row is red, and the bottom row is divided into four sections by green vertical lines, with purple horizontal lines separating the sections. Below the diagram is a 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. The overall interface has a light gray background with some decorative elements on the right side.

ANTHROPOLOGY AND HUMANISM  
Ethnographer as Apprentice: Embodying  
omusical Knowledge in South India  
da Weidman  
ublished: 26 December 2012 Full publication history

Volume 37, Issue 2  
December 2012  
Pages 214-235



# A3R Document Viewers as Embedded Components

Publishing 1  
Publishing 2  
Publishing Slide 3  
Publishing Slide 4

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 screenshot shows a chemistry application interface. At the top is a menu bar with options: 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 a search bar showing "Showing 157 results." Below the search bar are filters for "ENT" (157 results), "CS", and "JRCemi" (37 results). The main area features a large 3D ball-and-stick model of a molecule, with atoms represented by spheres in blue, yellow, red, and white. To the right of the molecule is an embedded window titled "SONIC Reader". This window contains a "Springer Keyword Search: Cysteine" interface with links to "Springer Web Search Home" and "Search Saved Articles". At the bottom of the application window is a URL: "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 by 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 texts — including audio files, videos, and 3D graphics scenes or models.

*Ailurus fulgens styani* (also known as *a. f. fulgens*): Only found in China (in the Hengduan

Mo  
My  
The  
ab

In this case a video player is launched in a dialog box, floating above the article text. For those reading digital books or articles, videos and other multimedia content can be presented through secondary windows launched via context menus; text and multimedia may thereby be viewed side-by-side.

## Behavior

Red pandas are generally solitary, but there are a couple of cases where they develop extended associations with their mothers that last throughout the breeding season.



In terms of territoriality, red pandas tend to have overlapping home ranges with other. This means that they do not search for their own food, but instead patchily distributed across the landscape.

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

ARKIVE  
www.arkive.org

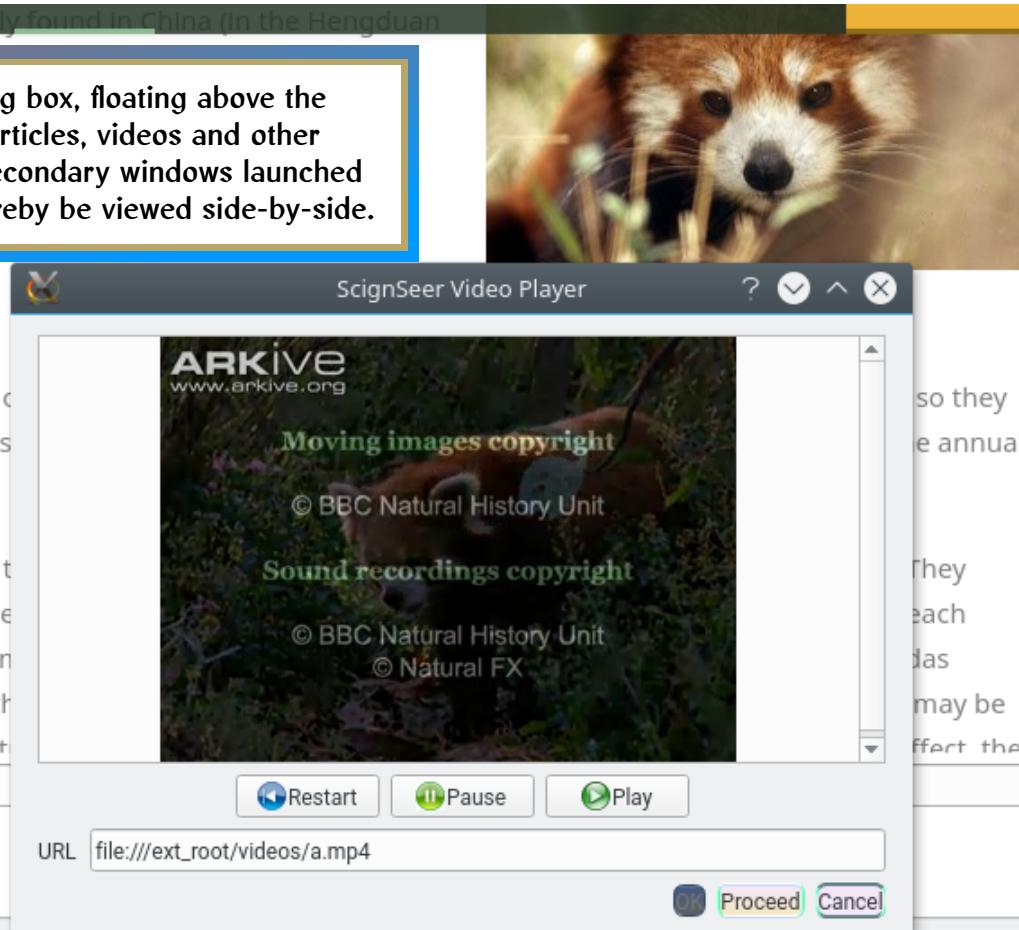
Moving images copyright  
© BBC Natural History Unit

Sound recordings copyright  
© BBC Natural History Unit  
© Natural FX

Restart Pause Play

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

OK Proceed Cancel



# Thank You!

Thanks

Please contact Linguistic Technology Systems for more information about NA3 and/or other Software Development and Software Language Engineering Solutions: (917) 817-2184.

