# The NCN/A3R ("NA3")

## Native Application Development Framework


# PITCH DECK

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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.

## Quality Assurance and User Acceptance Director

Ara Mehetarian, former head of Quality Assurance at Random House and AIG.

## 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.

## 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 12 academic books on natural language processing, speech recognition, text mining, speech and automata, forensic speaker recognition, mobile speech, and cyber-physical systems and smart homes.

# Capital Raising for Round A, ROI, and Exit Plan

- New Jersey-based home-grown female-headed software development company launching "Round A" between $1.5 and $2 million.
- Conservative burn with 5 year exit plan.
- Company valuation at $100 Million at exit. [1]
- Business model: customization, hosting, and licensing. [2]

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[1] See Slide 13 for development stages and exit strategy.

[2] See Slides 11 and 12 for details.

# Vertical Markets

- **Scientific Computing** NCN can provide a canonical framework for implementing cloud back-ends to augment the capabilities of technical/scientific desktop software.
- **Bioinformatics and Pharmacology** With a software-development environment combining powerful GUI development with rigorous data modeling, NA3 streamlines the implementation of complex applications managing multi-faceted data structures at both the analytic and User Interface level. For example, biomedical/bio-pharmeceutical software typically integrates clinical, chemical, demographic, epidemiological, and imaging/radiological data into a unified platform.
- **Civil and Industrial Engineering and Educational Software** NA3 can augment engineering, educational, and industrial-design applications with cloud back-end services, with inter-application networking/workflow capabilities; and with multi-media publication viewers, for a richer reading experience of documents describing engineering or industrial designs and artifacts, as well as of instructional and test-preparation materials in an educational context (see slides 16-20 and 28-31).
- **Cyber-Physical Systems** NA3 can be used to implement rich-client monitoring software paired to cloud services hosting realtime IoT data.
- **E-Commerce/Real Estate** NA3 can help developers implement rich-client front-ends (as alternatives to web applications) for sectors such as e-commerce and real estate (see slides 21-27 for capabilities uniquely available to native front-ends).

# Baselines For Projecting LTS Growth

**This slide considers sample Qt-based or innovative GUI-focused companies to establish a baseline for assessing the future growth of LTS.**

- **The Qt Group Plc** *€45.6 Million annual revenue* (source: Qt) Financial records released by The Qt Group suggest that commercial "Developer" and "Distribution" licenses are Qt's largest revenues source: The Qt Group aims for 60% revenue from licenses, 20% from consulting, and 20% for "support and maintenance" — total net revenue across these sources was the equivalent of US $57 Million.

- **ICS (Integrated Computer Solutions)** *US $25-50 Million annual revenue* (source: Glassdoor) ICS specializes in custom software development for companies in the military, aeronautics, and biomedical sectors. ICS exemplifies a Qt company whose revenue derives mostly from customization and consultation.

- **Toradex** *US $16.2 Million annual revenue* (source: owler.com) Toradex specializes in microprocessors and embedded systems, one of the largest of several Qt partners focusing on embedded systems with Qt front-ends for touchscreens and/or desktop consoles.

- **Galois, Inc.** *US $43.80 Million annual revenue* (source: RocketReach) Galois is not a Qt partner, but they have published sophisticated research on UI implementation and Functional Programming, helping to lay the scientific foundation for next-generation rich-client software, as well as cyber-security and software trustworthiness.

# Our NCN (Native Cloud/Native) Protocol

## Cloud/Native Components as Back-Ends for Native Software

- Our "Native Cloud/Native" service is a protocol, which 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).
- Our NCN and A3R technology (collectively referred to as NA3) can be ported to other (non-Qt) application frameworks (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

# How NCN Addresses 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, there is 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.

# How NCN Addresses Limitations of the Semantic Web

Many experts have critiqued the Semantic Web for lacking conceptual rigor, adequate modeling for multi-scale information, and intrinsic representations for Quality Assurance Requirements. To address these limitations, NCN introduces new Semantic Web technologies with the following features:

## The Application-as-a-Resource (A3R) Model

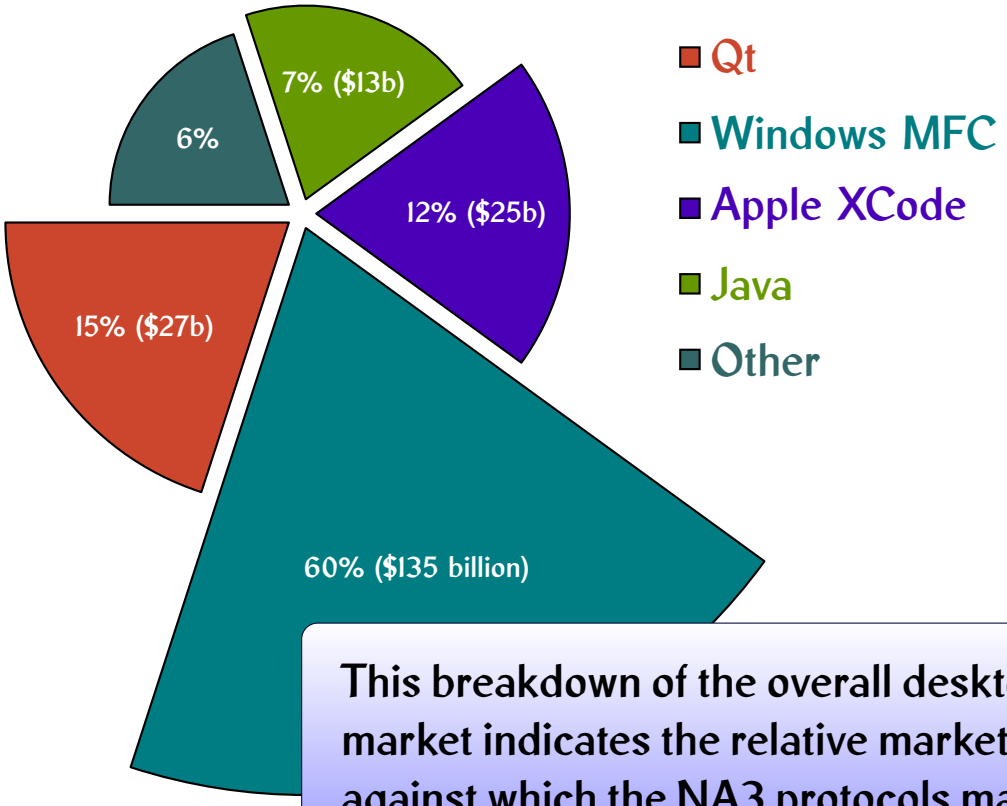
- A3R Applications are self-contained, citable resources and tools which can conform to modern resource documentation standards, such as the Research Object protocol.
- A3R includes a representation for natural language publications (e.g., books and articles) that unifies different manuscript formats (such as XML, LaTeX, and XCONCUR).

## Multiscale, Requirements-Focused Resource Description

- NA3 incorporates Semantic Web alternatives with greater Requirements Engineering and Quality Assurance precision, such as Conceptual Space Markup Language.
- Hypergraph-based Resource Framework to intrinsically support multi-scale data structures.
- Workflow-oriented “Meta-Procedure” Interface Definition framework to enforce procedural alignment among applications.

# 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.

# Our NCN Business Strategy

## Within the Qt Market

- Promote NCN as a standard solution for Qt/Cloud Integration.
- Promote NCN developer tools for custom Qt scripting/markup languages.
- Promote NCN's Semantic Web protocol as a standard model for inter-application networking, describing applications, and serializing application-specific data structures.
- On the basis of these enhancements to the Qt ecosystem, LTS hopes to join the **Qt partners** program, which would expose NCN's unique features to a worldwide developer community.

## Outside of Qt (see slide 14)

- Port the NCN Protocol implementations, C++ reflection model, and hypergraph libraries to standard (non-Qt) C++ and other languages.
- Implement language-agnostic hypergraph serialization to allow NCN networking between applications written for different operating systems and/or programming languages.

# NCN Revenue Sources

- **Customization** Custom-implemented applications using project-specific versions of NCN and/or A3R (see next slide).
- **Licensing** Commercial licenses required for any deployment of NCN outside LTS-controled servers and/or any commercial deployment of A3R applications.
- **Hosting** Running proprietary containers via a Cloud-Native service such as OpenShift, LTS can offer integrated hosting and consulting wherein LTS fully implements and maintains a back-end paired to any desktop/native client software. (Because the expertise involved in building native desktop applications is very different from the techniques required to deploy a Cloud-Native container image, the option of delegating all backend responsibilities to LTS may appeal to Qt-oriented development teams.)
- **Sponsorship** Running a data-sharing platform which would be a publicly-visible introduction to NCN. This “demo” container would host research data sets (and would therefore be a resource in the public interest) allowing LTS to receive compensation from companies financially supporting the portal because it is a technology which benefits science and research.

# Customization and Monetization

**All development and licensing figures quoted below are per-client**

- **Custom NCN Servers** LTS builds special versions of NCN which natively recognize client's application-specific data types, preferred serialization formats, and client/server interface definitions.
  (dev: $75K; licensing: $10K/month)
- **Custom Markup and Scripting Languages** LTS builds scripting and/or markup languages customized for clients' unique data and interface requirements. These custom languages may be used for data serialization, testing, prototyping, and runtime fine-tuning of application behavior.
  (dev: $250K; licensing: $10K/month)
- **Custom GUI Components** LTS builds GUI classes on client's behalf, which natively support NCN integration. (dev: $50K; licensing: $5K/month)
- **Workflow Management** LTS customizes networking protocols so that multiple applications may be unified into distributed workflows.
  (dev: $50K; licensing: $15K/month)

# ROI and Development Phases

I (9-12 mos) Establish a hosting platform (projected to take the form of a RedHat Enterprise Service or Kamatera Partner affiliation) within which LTS can license individual cloud back-ends on a per-client basis, paired with clients' desktop front-ends. We will make tools available to help developers create applications that leverage NCN back-ends, including those hosted by our company.

II (1-2 yrs) LTS will prioritize marketing its development libraries and cloud service, with an emphasis on explaining to Qt-based companies that the LTS hosting option provides functionality similar to the discontinued Qt Cloud Services.

III (2-4 yrs) Generalize NA3 to standard C++ (eliminating Qt dependencies), implement NA3 in an Apple-specific version targeting XCode, port NA3 to Java, and build a Windows-specific implementation via MFC.

IV (5th yr exit) With NA3 now realized in Qt, Windows, Mac, and Java versions, consolidate each of these implementations into canonical container prototypes, such as RedHat "Cartridges". This collection then becomes a comprehensive, multi-platform desktop/cloud integration technology valued at $100M, potentially sold as a product suite to cloud and/or desktop-software vendors such as RedHat, Autodesk, Amazon (via Amazon Web Services) or Adobe.

# NA3 In Different Software Ecosystems

**Potential NA3 Markets**
**(see Slide 9 for overview)**

Windows MFC (~$135b market size) NA3 components can be implemented in MFC (Microsoft Foundation Classes) and 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 Linux-oriented A3R implementations 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++ NA3 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 – source: MarketsandMarkets) NA3 plugins can be added to new or existing applications to support inter-application networking, unifying multiple applications into workflow-management systems.

# Example Use-Cases

## Inter-Application Networking and Workflow Management

- Export data and instructions between Qt-based applications (slides 16-17).
- Embed document or multi-media viewers inside scientific or dataset applications (slides 28-31).

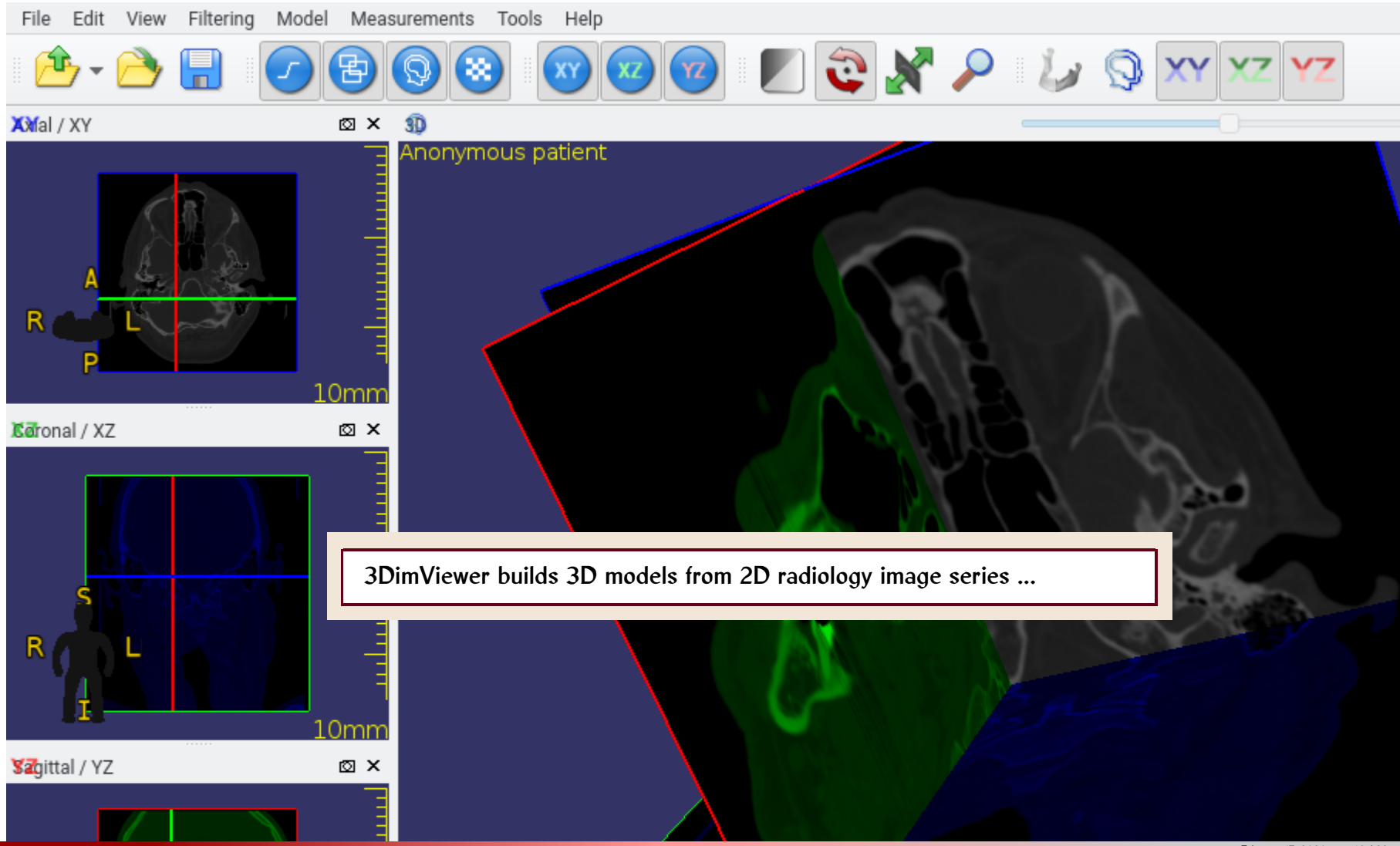
## Responsive desktop-style applications for enhanced UX

*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: leftronic.com), Real Estate, VR, etc. (slides 21-27).
- For scientists and researchers, build innovative data-collection instruments as well as interactive Research Object applications (slides 18-20).

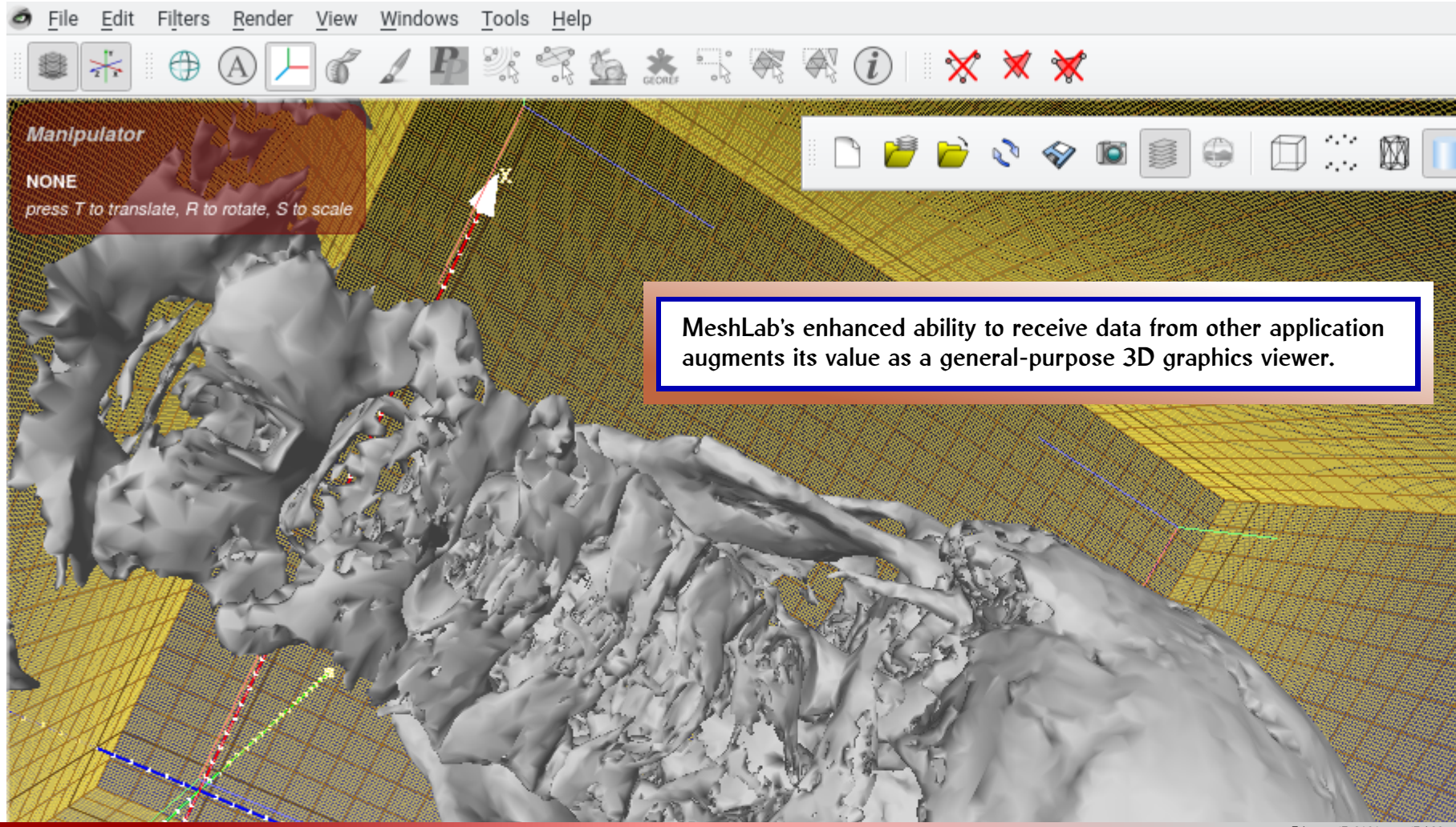
# An Example of Inter-Application Networking

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).



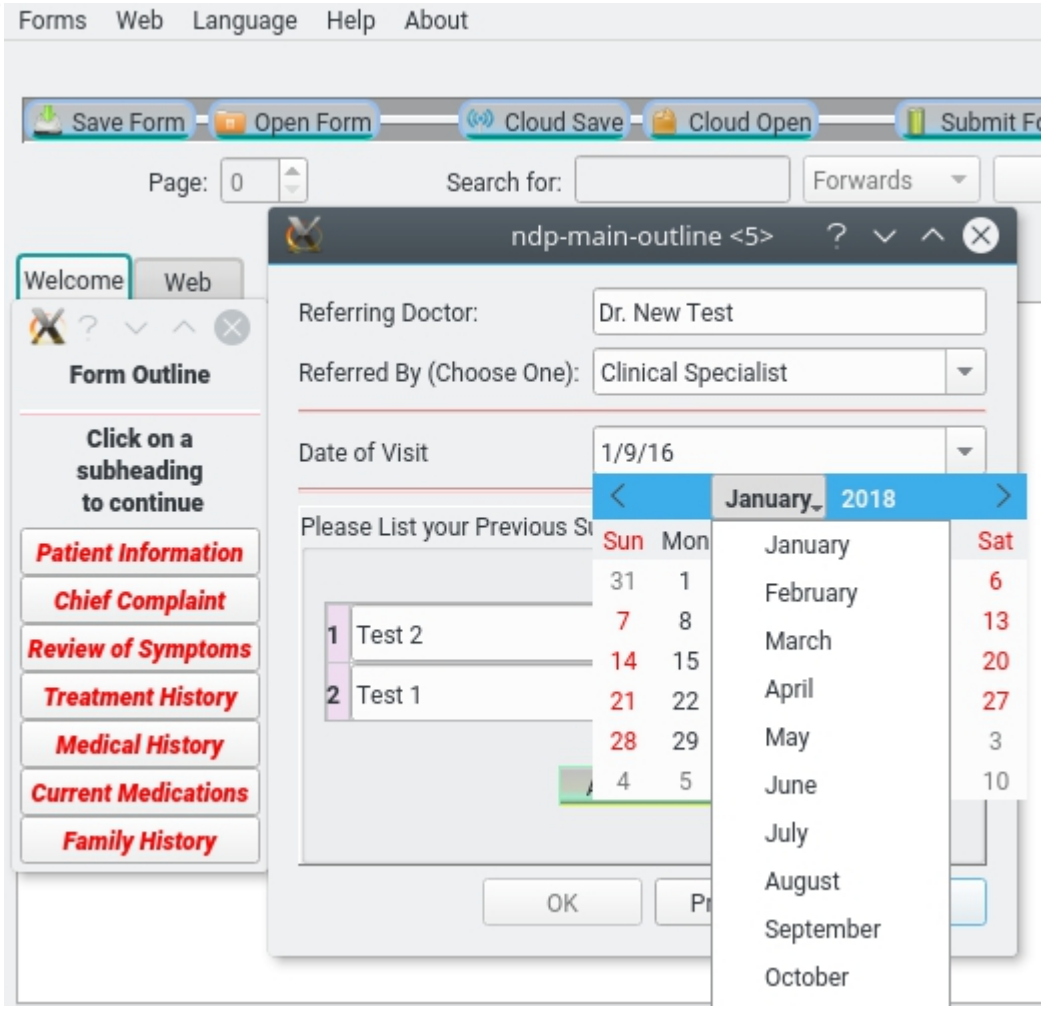
# 3D Graphics Sent to MeshLab

... 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.




MeshLab's enhanced ability to receive data from other application augments its value as a general-purpose 3D graphics viewer.

# A3R Applications as Data Collection Instruments

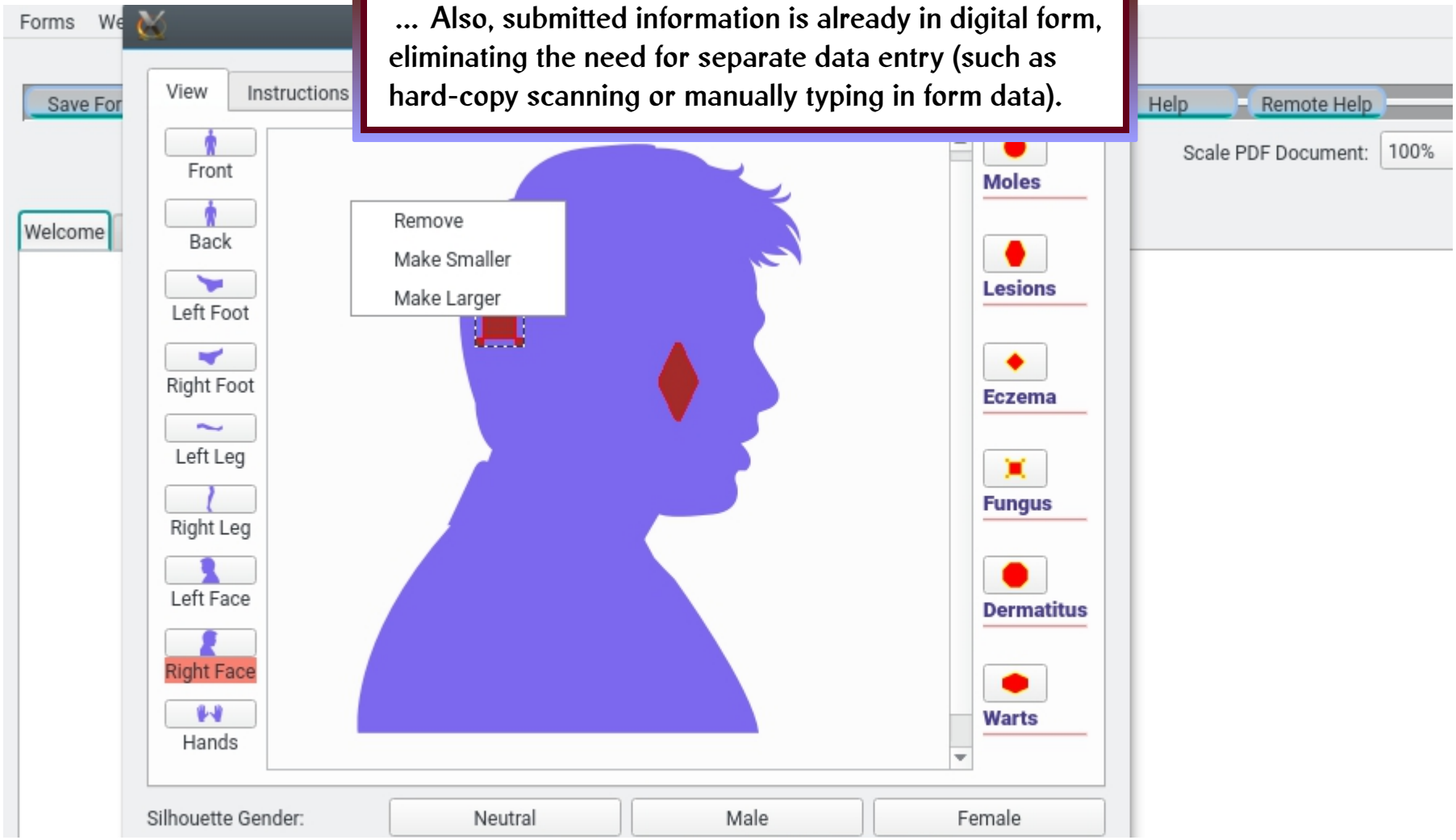



In medicine and social science, "data collection instruments" (DCIs) refer to surveys, questionnaires, and other tools to obtain human feedback.

# Qt-Based Interactive Forms

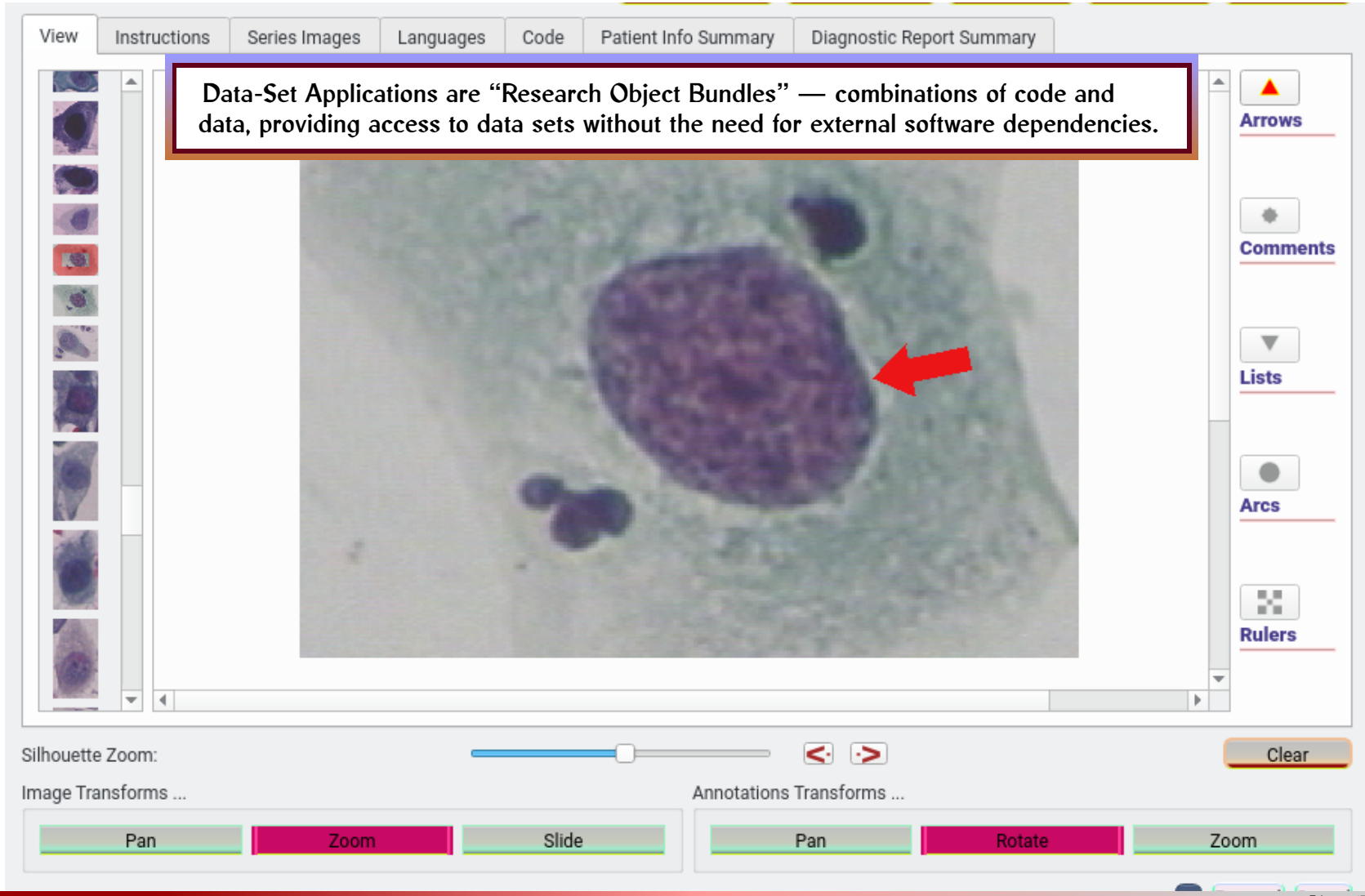
Data Collection Instruments implemented as native desktop applications can have easily navigable, interactive forms that make it simpler for people to provide information ...

... Also, submitted information is already in digital form, eliminating the need for separate data entry (such as hard-copy scanning or manually typing in form data).



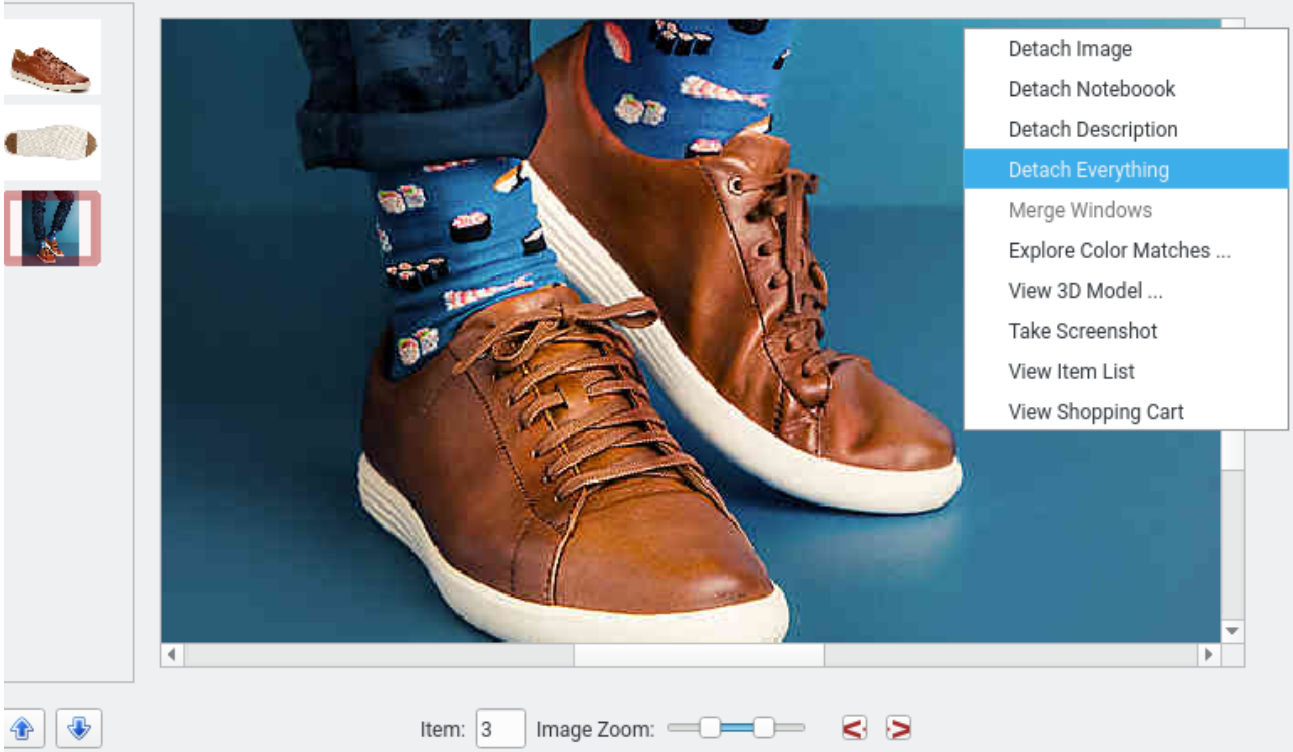
# A3R Applications as Research Objects

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.



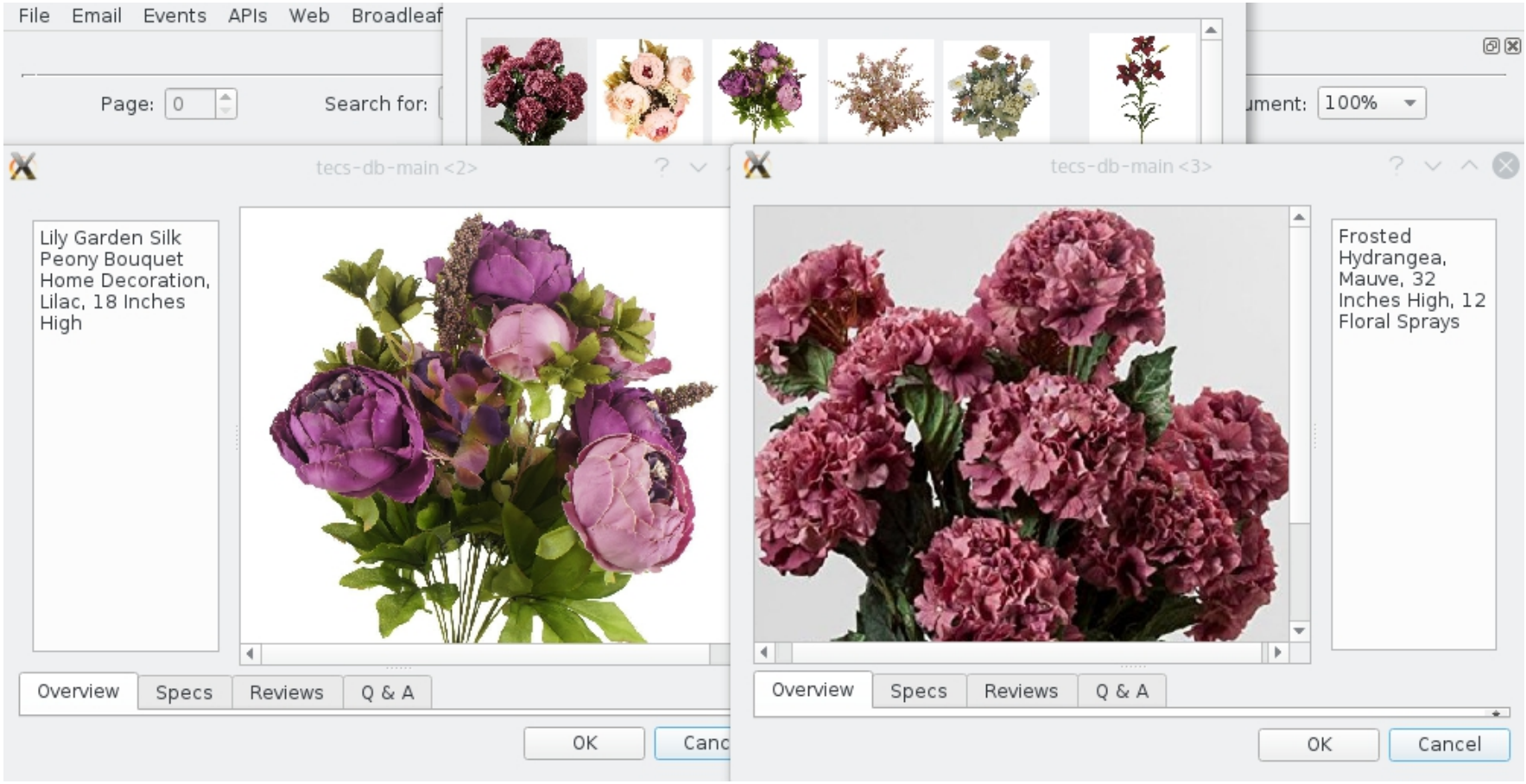
# Native Applications as Interactive Catalogs

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.



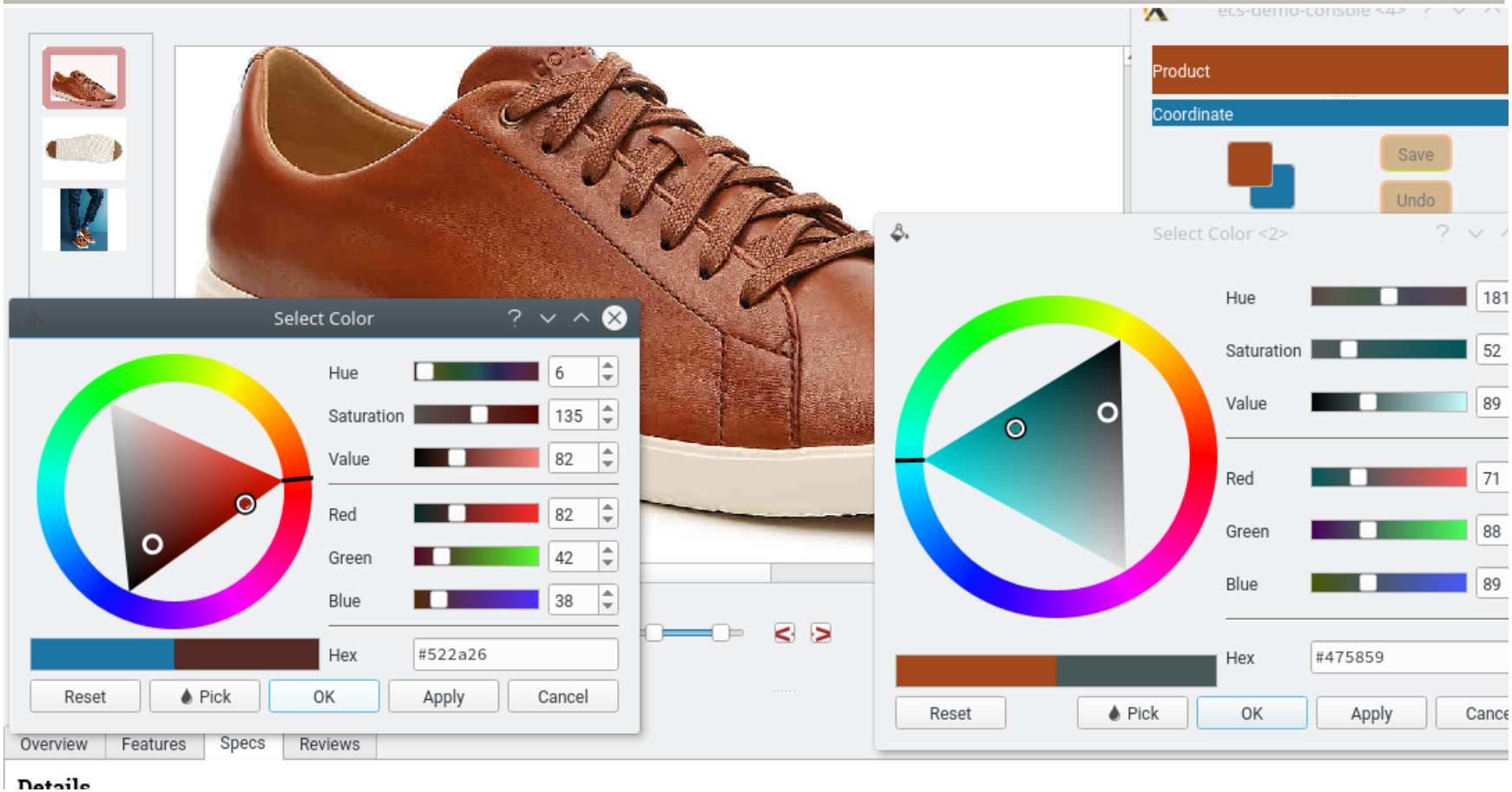
# Interactive Shopping Carts

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



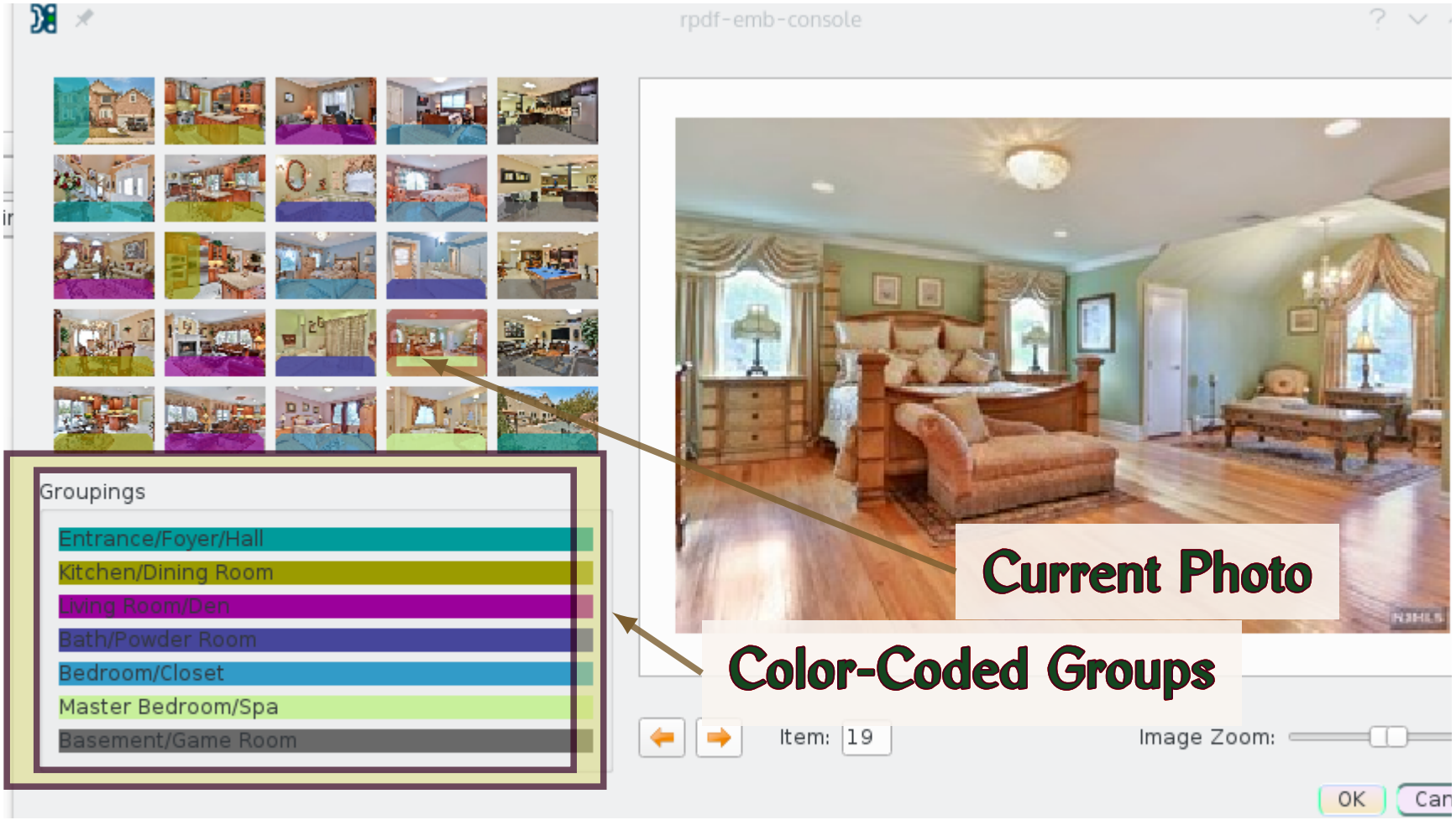
# Explore Products with Native Software

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.



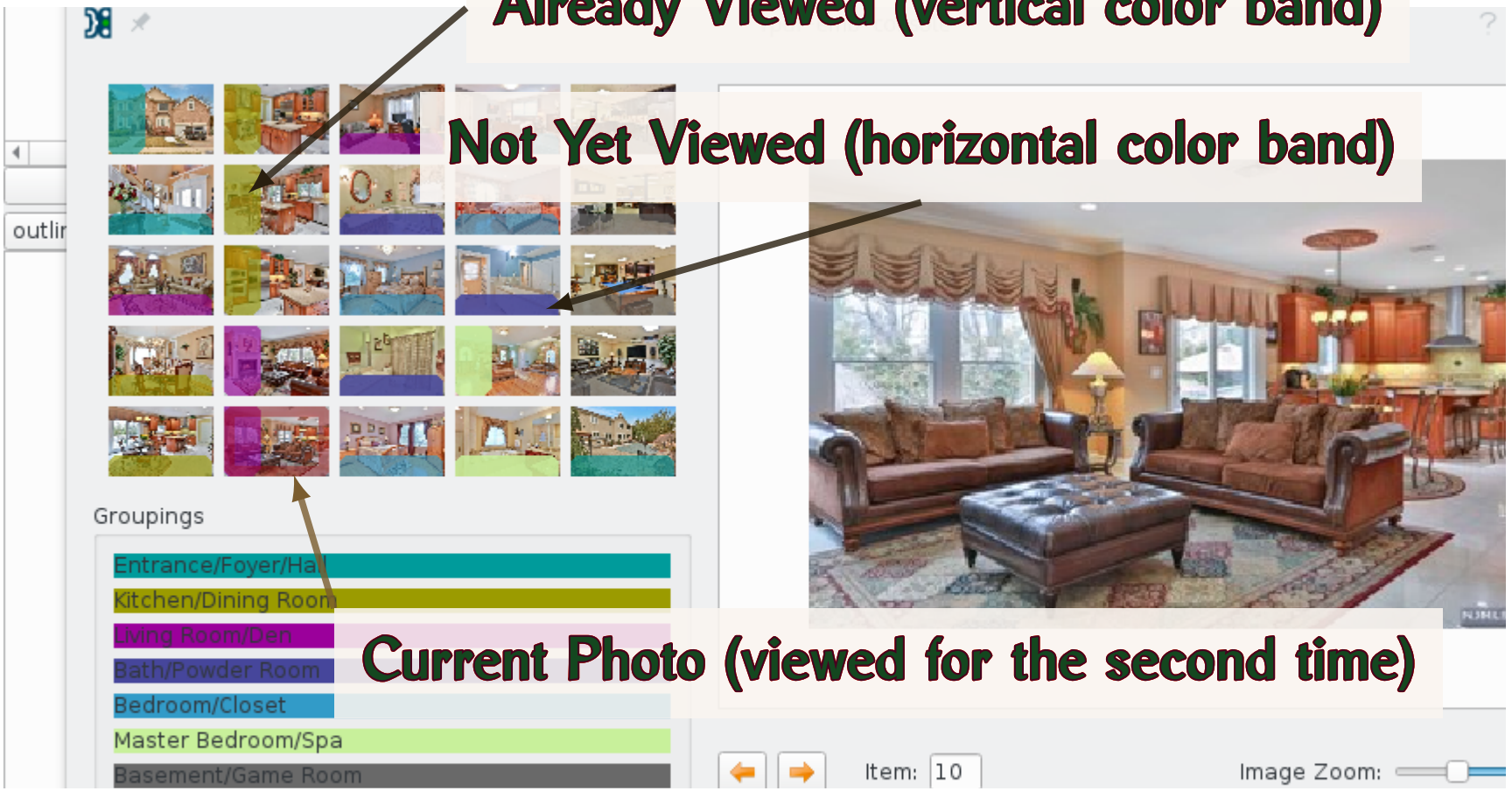
# Interactive Real Estate

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.



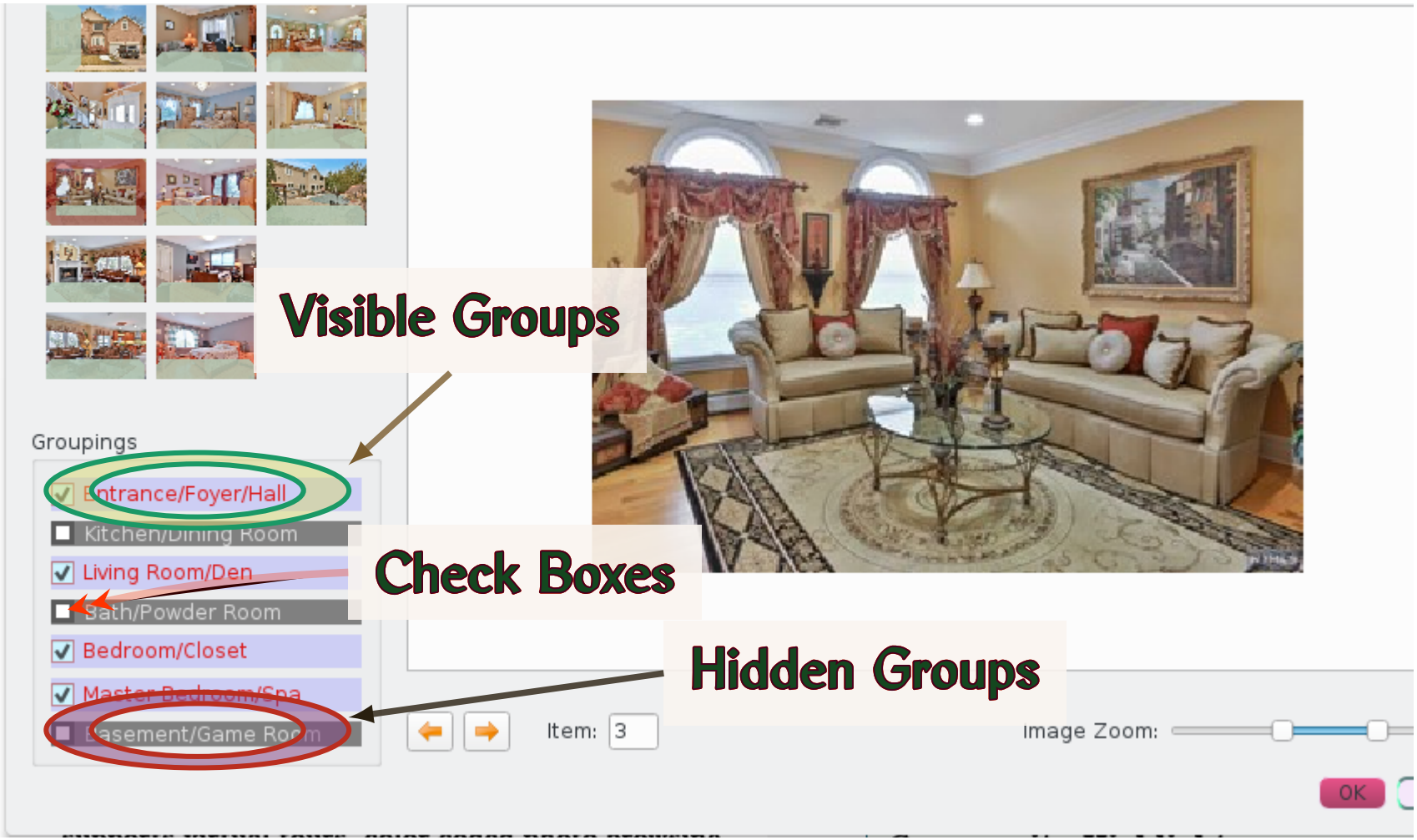
# Photo Viewer Interactive Cues

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).



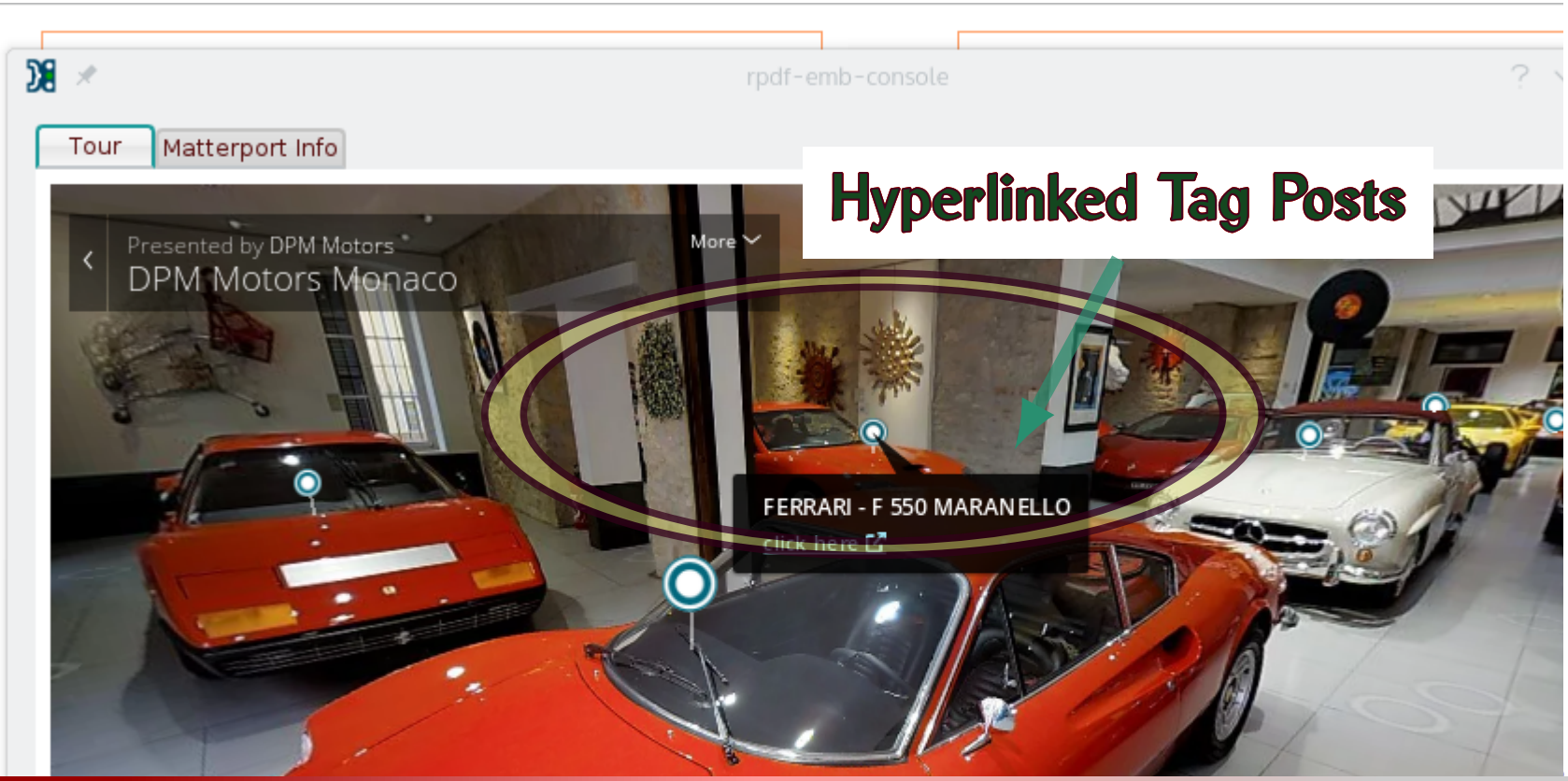
# Filtering Photos

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).



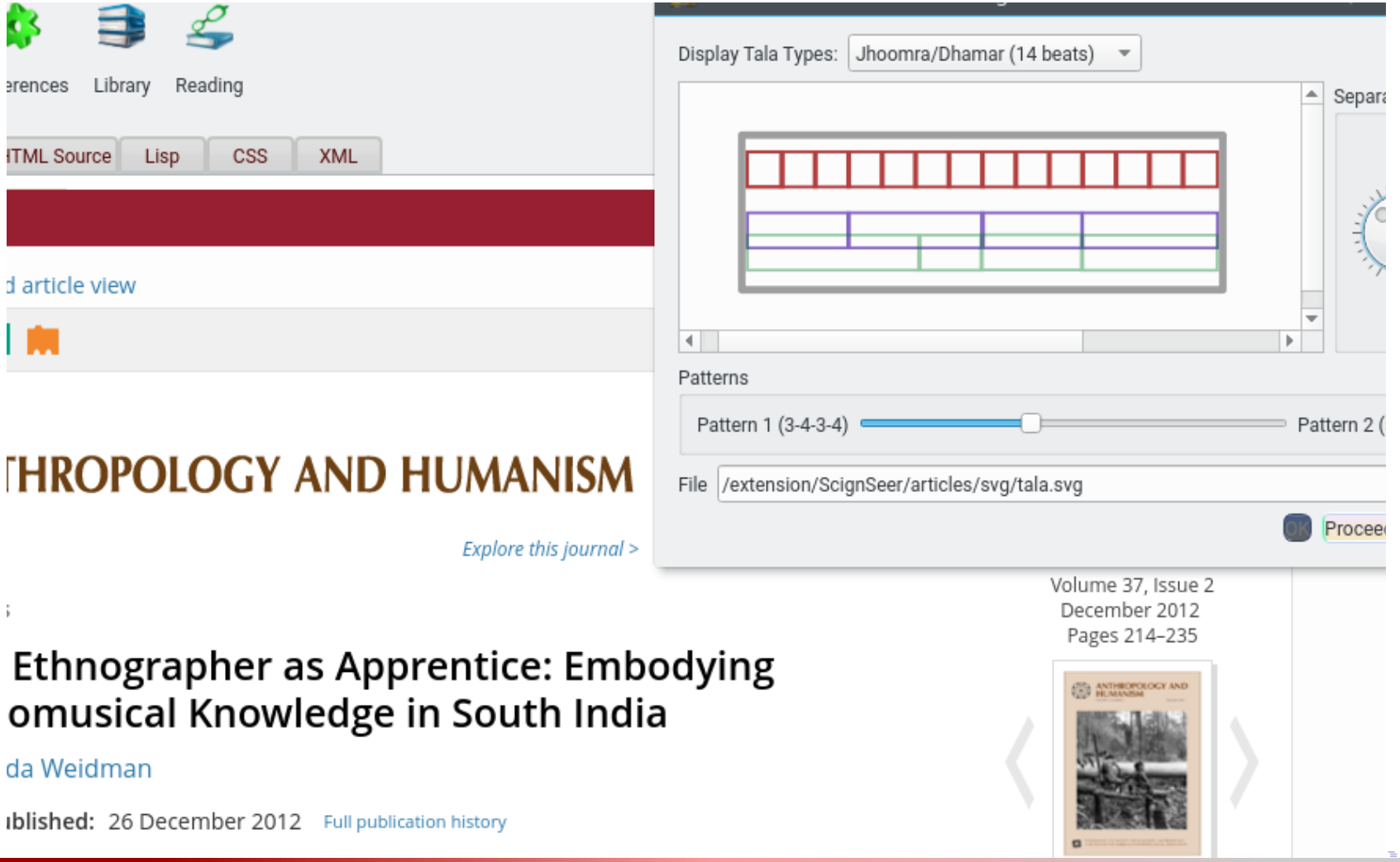
# Interactive VR: Hyperlinked Tag Posts

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.



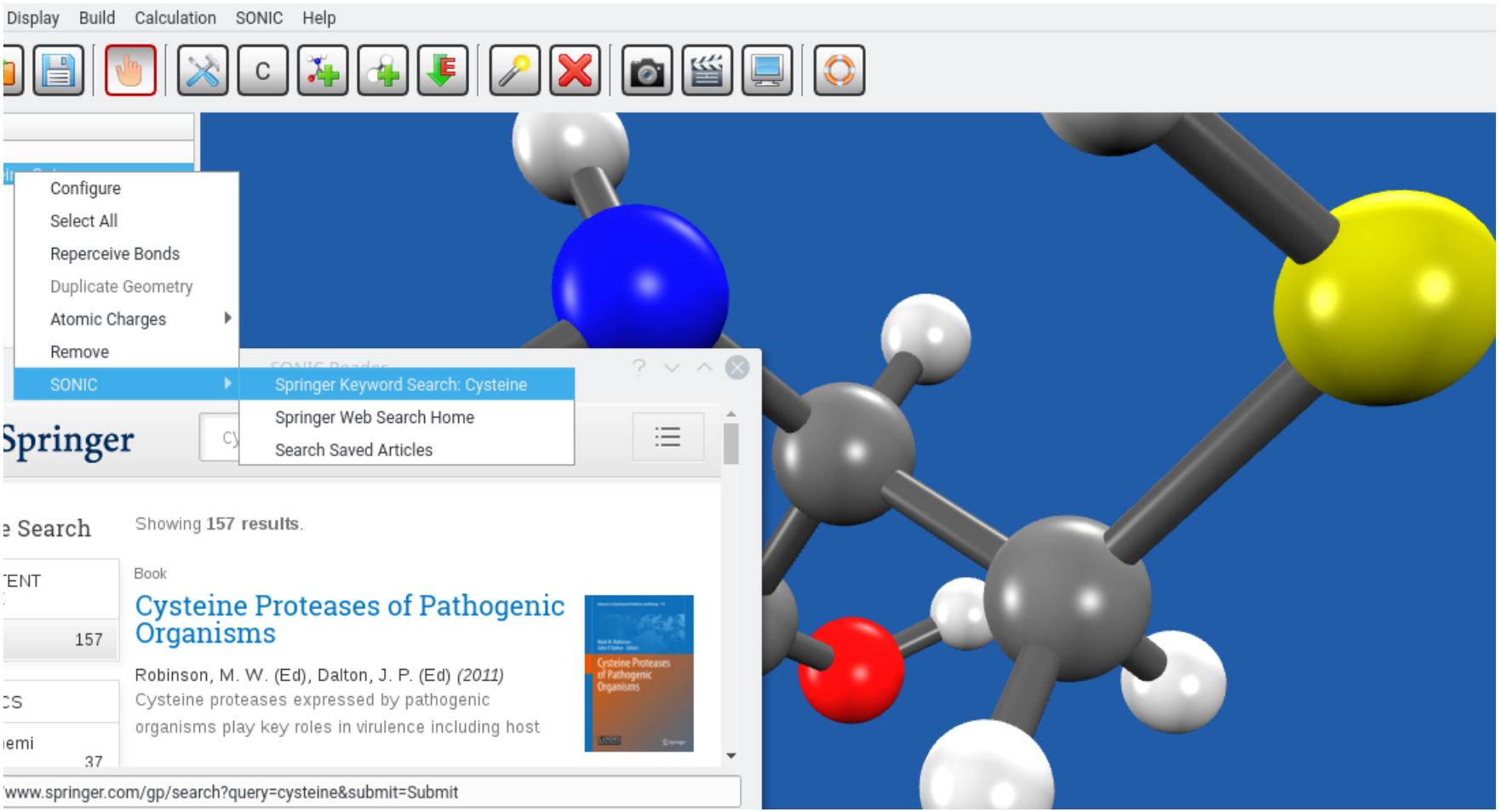
# A3R Document Viewers

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.



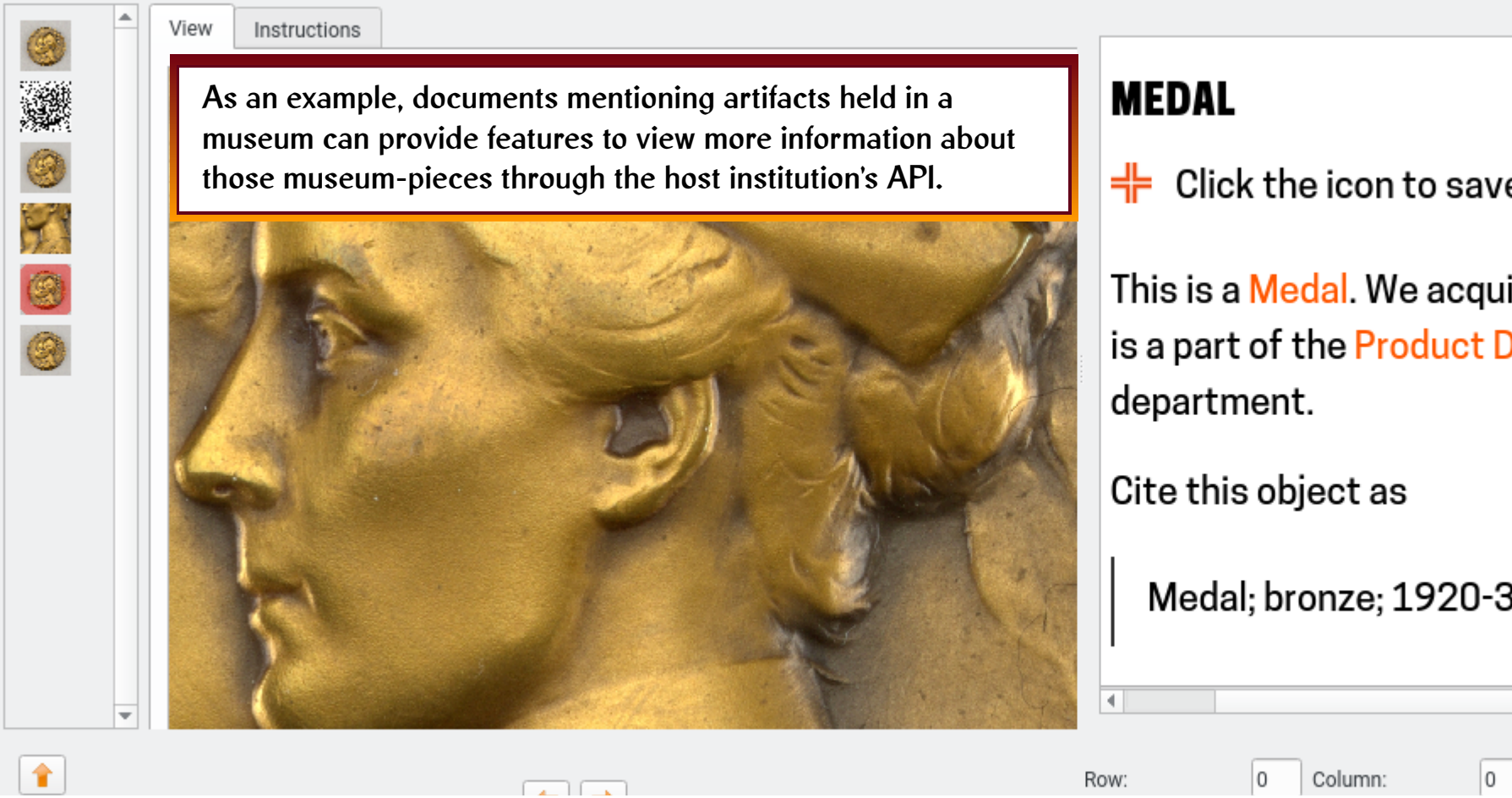
# A3R Document Viewers as Embedded Components

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.



# Document Viewers Augmented With APIs

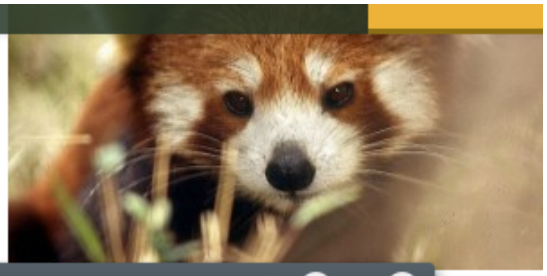
Another strategy for interactive publications is linking documents with APIs maintained by publishers, or by cultural or educational institutions.



# Embedded Multimedia

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.

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
develop extended associations with their mothers that las
breeding season.

rk.org/red_panda/about-the-red-panda/

ScignSeer Video Player


Restart Pause Play

URL file:///ext_root/videos/a.mp4

OK Proceed Cancel

# Thank You!

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