

JAVA APPLETS AND MULTIMEDIA CATALOGUES FOR STATISTICS EDUCATION

Hans-Joachim Mittag
University of Hagen
Germany

The present paper describes a prototypical multimedia catalogue for Statistics. The catalogue represents a user-friendly organized database containing a collection of self-contained Java applets and multimedia components. It is a powerful tool which offers the option to jointly use and re-use catalogue elements across national borders and to interconnect formerly unrelated multimedia developments through sharing. In view of the costs of producing high-quality multimedia components, the systematic exchange of such modules is economically a necessity. The scope and flexibility of the approach and its suitability as a starting point for intensified international cooperation is illustrated by means of Java applets and multimedia elements originating from different environments and different content providers.

INTRODUCTION

Interactive Java applets and multimedia components have huge potential to improve the quality of Statistics teaching. Undoubtedly, such elements give access to new dimensions of learning. They offer a user-friendly platform for visualizing statistical concepts and for discovering basic statistical principles by means of user-controlled experiments and virtual laboratories. Numerous educational institutions and individuals have already started to exploit this potential and developed useful WWW resources, multimedia elements or complete electronic textbooks and tutorials. One may already observe a great variety of interactive and animated learning resources suitable for considerably enhancing the quality of teaching Statistics. Remarkable collections of WWW-supported interactive statistical experiments have been put together, for example, at the University of Huntsville in Alabama and by a consortium of Belgian Universities (see www.math.edu/stat/ and www.kuleuven.ac.be/ucs/java/index.htm, respectively). Due to an obvious lack of systematic cooperation between content providers, the existing resources are still heterogeneous with respect to design and didactical approach and mostly unrelated. An incomplete overview on Java applets suitable for modern Web-supported statistical education is accessible via <http://noppa5.pc.helsinki.fi> or <http://www.stat.sc.edu/rsrch/gasp> (see also Saporta, 1999).

In order to avoid re-inventing the wheel and to improve cost-effectiveness, there seems to be a need to promote systematic international multimedia cooperation between educational institutions. Cooperation could aim at jointly designing and using Java applets and multimedia components for Statistics education, at exchanging such elements and at interconnecting existing Web resources.

A PROTOTYPICAL MULTIMEDIA CATALOGUE FOR STATISTICS EDUCATION

Within the framework of a European project, a multimedia catalogue has been developed at the University of Hagen in cooperation with several Universities and publishers as well as with software companies. The project output, currently presented on the Web at <https://mmk.fernuni-hagen.de> and described in detail by Krämer and Steinmann (1999), is a component-based hypermedia development relying on self-contained multimedia elements. The catalogue is hierarchically structured and ordered by disciplines. Statistics is one of the disciplines already covered. This paper only refers to the multimedia catalogue "Statistics" which formally represents a sub-catalogue of the interdisciplinary multimedia component repository. Figure 1 shows how the catalogue is organized. Each catalogue entry consists of a Java applet or a multimedia component. The language of each element is indicated by flags and the nature of the component (Java applet, animated theory, written or spoken comments, videos, etc.) by illustrative icons. The catalogue excerpt displayed in figure 1 contains a list of Java applets in English, German or Spanish.



Figure 1. User Interface of the Multimedia Catalogue for Statistics Education.

After activating a catalogue entry, one gets the Java applet or multimedia component as the core element, a content description with meta-data, and information about use or re-use. Figure 2 gives an example referring to the first entry of the list displayed in figure 1. The figure shows a Java applet "Coin experiment" in English. The catalogue also contains separately-stored written comments related to the simulation experiment.

The catalogue architecture strictly follows modern software engineering principles, such as re-usability, interoperability and platform-independence (for details, see Krämer & Schmidt, 2001). Each catalogue component is characterized by meta-data according to the learning object meta-data standard (LOM). The re-use conditions depend on the implemented business model, which depends on agreements between the parties involved. Non-profit educational institutions may prefer a free academic exchange mart with balanced rights and obligations or a credit-point model. Commercially-operating content-providers could apply a pricing model based on payment via e-cash.

The screenshot shows a Netscape browser window titled "Netscape: Coin experiment". The address bar contains the URL "https://muk.fernuni-hagen.de/nmce3bc1a64e5c8c3". The main content area is divided into several sections:

- Navigation:** "Catalogue", "Workspace", "Contact", "Search", "Shopping-Cart", "Identify", "Profile", and "Help?".
- Description:** A text block explaining that the applet visualizes the outcome of tossing a coin n times, with observed relative frequencies $f_i(\{H\})$ and $f_i(\{T\})$.
- Attributes:** A "Modify" section with fields for:
 - Title: Coin experiment
 - Language: English (UK)
 - Structure: Atomic
 - Level of aggregation: 0
 - Interactivity type: Active
 - Interactivity level: high
 - Learning time: 0:10:0
- Component:** An interactive area with:
 - Controls: $n = 500$, "Start", "Stop animation".
 - Graphs: A line graph showing $f_i(\{H\}) = 1 - f_i(\{T\})$ over i (0 to 500), a bar graph for "Outcome" (H and T), and a table of $f_n(\{H\})$ values.
 - Checkboxes: Three options for additional visualizations and mean outcome display.
- Reuse Conditions:** A section with contact information: "Please contact joachim.mittag@fernuni-hagen.de at University of Hagen, Germany."

Figure 2. Element of the Catalogue with Descriptive Information (Meta-Data).

SCENARIOS FOR USING THE CATALOGUE

The Statistics catalogue as a repository of shareable and re-usable educational resources may be employed in different ways:

- An obvious application is the direct use of isolated multimedia components and user-controlled experiments as a supplement to traditional teaching media at colleges, secondary schools or at the shop floor. Integrating innovative multimedia components into classical lectures contributes considerably to improving the quality and scope of teaching and learning. Multimedia also represents an ideal complement to static textbooks by offering an ideal

platform for visualizing statistical concepts and for trying them out on the basis of learner-controlled animations and simulations.

- Around the catalogue an open market place could emerge with universities and possibly also software companies as the core content providers. Instead of re-developing already existing multimedia components, course developers will share educational resources, modify and combine them according to local curricula and local needs. A systematic cooperation between different educational institutions, aiming at coordinating multimedia development already in the planning stage, undoubtedly represents a far-reaching and cost-effective approach.
- Prefabricated catalogue elements could also be used as a starting point for constructing new courses. Since the catalogue architecture supports the principles of component-based software engineering, selected components could easily be interconnected and integrated into customized learning environments.

It should be mentioned that most of the components of the presented catalogue are still originating from a single source, a highly modularly-structured multimedia software for Statistics education (Mittag & Stemann, 2001). This software contains numerous interactive experiments and animations with visualized theory or real life examples. In order to test the idea of establishing a Statistics catalogue aiming at promoting international multimedia cooperation, some components were removed from the original environment and used in different language versions as the nucleus of the catalogue. In the future, the other direction will be more important – constructing new material by interconnecting small elements instead of breaking down large learning resources.

OUTLOOK

Very soon, repositories for multimedia components will be natural and widespread tools for teaching Statistics and other disciplines. It is to be expected that a variety of networked multimedia catalogues, each enriched with topic maps and other powerful search facilities, will emerge for different purposes and different learning environments. The Statistics catalogue described above only represents a prototype suitable for gaining first experiences and giving an impetus to promoting hitherto neglected international multimedia cooperation.

ACKNOWLEDGEMENTS

Uwe Steinmann assisted with preparing the two screenshots of the multimedia catalogue. I am also indebted to Ulrich Marty for technical support and to Bernd J. Krämer for helpful discussions.

REFERENCES

- Krämer, B. J., & Schmidt, H.-W. (2001). Components and Tools for On-line Education. *European Journal of Education*, 36, 195 - 222. Available at <http://www.fernuni-hagen.de/DVT/Publikationen/pub2001.html>
- Krämer, B. J., & Steinmann, U. (1999). *A marketplace for multimedia components*. Paper presented at the International Conference on Distance Education, Vienna, Austria. Available at <http://www.fernuni-hagen.de/DVT/Publikationen/pub1999.html>
- Mittag, H.-J., & Stemann, D. (2001). *Multimedia Software "Descriptive Statistics and Exploratory Data Analysis"* (in German) (4th edn.). Germany: University of Hagen. . Detailed Information related to this software in English accessible via <http://www.fernuni-hagen.de/e-statistik>.
- Saporta, G. (1999). Teaching Statistics with the Internet: a Survey of Available Resources and the St@tNet project. *Bulletin of the International Statistical Office*, 52nd Session, 233 - 236.