# Analysis of Interactive Multimedia Features in Scientific Publication Platforms

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**Abstract.** Some platforms provide another dimension in published articles, using interactive enrichments to explore related content and help readers test their understanding. In the case of scientific publication platforms, incorporating these features and providing the user with additional content remain a challenge. Therefore, this study based on the taxonomy of Paul, analyzes how interactive multimedia resources are used on different scientific platforms with hypermedia systems. The paper discusses the usage of these features and how current practices could be improved for other scientific publication platforms.

**Keywords:** Hypermedia · Interactivity · Information behaviours

## 1 Introduction

Scientific publications are essential elements in the dissemination and evolution of science and new technology. They are used as a support for retrieving information as well as staying updated, providing cooperation and integration among researchers. Through scientific publications, research findings on various subjects are presented, contributing to the recognition of scientific discoveries, and confirming the competence of the researcher in the scientific community.

Digital libraries must improve their efforts to provide users with effective and flexible access to materials which will, in turn, empower them to make new observations and discoveries. As an example, recent studies have shown that the technologies currently available incorporate hypermedia systems as a powerful tool for the development of new scientific communication models, offering multimedia content (video, audio, animation, etc.), which create new interactive expectations in the reader [1, 2].

Hypermedia presents the possible integration of interactive systems with multimedia [3, 4], creating the prospect of application in articles hosted within the scientific publication platforms. Nevertheless, unlike cinema, it has a vocabulary all its own to define its specific features. The digital environments, as in scientific publication platforms, are still adapting their framework from other media. However, it is necessary for new practices and techniques along with a new vocabulary [5]. In order to create a specific vocabulary for scientific publications, this study first understands how interactive multimedia resources are used on different scientific platforms with hypermedia systems, the analysis adopts the benchmarks that were developed by Paul [5, 6].

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The present study seeks to identify the specifics of the digital environments of Paul [5, 6]. Scientific platforms have been selected which represent a sample of the three types currently available, open source platforms, closed source platforms and collaborative platforms. Thus, there is a general understanding of how different platforms use interactive multimedia resources in their scientific publications.

The paper is organized into four main sections, section one is the introduction; section two is the analysis of scientific publication platforms; and section three is presented as the discussion and conclusions of this study.

## 2 Analysis

Paul [5, 6] states that interactivity is essential for digital environments. In fact, interactivity is important for the scientific publication platforms, but it is a concept that still lacks a precise definition. To address the issue of an absence of specificity and overcome the imprecision of the term "interactivity", they have developed a taxonomy for digital narratives, which can be applied to the narratives of scientific texts. In the taxonomy developed by Paul [5, 6], five main elements are discussed: (1) media, (2) action, (3) relationship, (4) context and (5) communication.

Media – The material or information can have different properties. Paul [5, 6] discusses properties such as media type (e.g. text, video, and image), the configuration - single media, multiple media or multimedia, and the rhythm (or flow) - whether the content is asynchronous or synchronous.

Action – This element concerns the actions for two distinct aspects: the movement of the content itself and the action required by the user to access the content. This element refers to the digital environment as being dynamic or static, and in regards to the need for the user to participate in order to move content, active or passive.

Relationship – This discusses the relationship between the user and the content. It manifests itself in a combination of five types: linear or non-linear, customizable or standard, calculable or non-calculable, manipulative or fixed, and expandable or limited.

Context – Refers to how much the content of the narrative can be more than offered in its space, such as links or external content that relate to the narrative offered. In the case of the presence of these links, the context is considered hypermedia, having built-in or parallel links, internal or external, supplementary or duplicative, and contextual or related.

Communication – This element refers to the ability to connect with others through digital media. In this element, the configuration can be one-to-one, one-to-many, and many-to-one or many-to-many, depending on the amount of agents involved.

For instance, different types of communication (e.g. video, e-mail, chat and forum) are discussed, as well as the purpose of the communication. The study analyzes three selected scientific publication platforms: Elsevier (closed source), Plos One (open source) and Pub Pub (collaborative platform). A publication of each platform was analyzed. The scientific area and the theme of the publications used in the analysis of the platforms will not be considered. It will only consider what features the platforms provide and how is the integration of these features with the scientific publication.

### 2.1 Elsevier

The Elsevier platform provides web-based solutions for science, health, and technology professionals. The Elsevier project called "The Article of the Future" explores better ways of presenting online journal articles and enriching their content in regards to three key elements: presentation, content and context. Its main goal is to offer new content and tools that would help researchers in their specific scientific needs.

Conforming to the taxonomy of Paul [5, 6], the analyzed scientific publication[1] inside the Elsevier platform presents in its content, the different types of media separately, that is, static (text and images) in the center of the publication body, and dynamic (video, as additional information) in the margin. Even so, it is featured with a multimedia publication. Some Elsevier journals offer multimedia content such as videos and podcasts that are not included in the full text.

The layout features different levels of attention. Thus, in relation to the action, the content is static and active when the user navigates by clicking the left menu or links. The publication has three-pane-based content exploration. Consequently, the content movement is non-linear and non-calculated. Since each pane can be scrolled independently, it is possible to see both the text (on the middle pane) and an image (on the right pane sidebar) at the same time.

The left navigation pane displays a clickable section of content and thumbnails of images and tables. There are two options for navigation: with or without figure and table thumbnails displayed (customizable content). The right pane provides access to supplementary information (cited, metrics, related content and featured multimedia).

The content is fixed as more information to the content cannot be added, but it is expandable with links to related content. In addition, regarding presented links, the context is considered hypermedia, having parallel links, internal (dropdown menu) and external (references), supplementary and duplicative (featured multimedia - video) and recommended (recommended articles). Based on Paul [5, 6], communication is the element that refers to the ability to connect with others through digital media. In this way, the journal´s configuration of communication is one-to-one, allowing the user to send emails to one of the authors to exchange information or ask questions.

### 2.2 Plos One

Plos One is an international journal, it presents research publications from all disciplines in the field of science and medicine. By not excluding articles based on the subject area, it is possible to discover connections between papers or across disciplines. Authors can send support files and multimedia files along with their manuscripts. The Plos One publishing platform supports several file types for the information system. Therefore, it imposes specific requirements and formats for multimedia files.

Concerning the taxonomy of Paul [5, 6], the analyzed publication[2] presents in its content, static and dynamic media, characterizing it as a multimedia publication

[1] Viewable in: https://www.sciencedirect.com/science/article/pii/S0022314X13002424.

[2] Viewable in: http://journals.plos.org/plosone/article?id=10.1371/journal.pone.0111730.

(text, video and animations). In relation to time and space, the content has a menu bar that affords the ability to navigate between parts of the paper.

As follows, the content is static and active, the reader is encouraged to click (on the links, slide images, buttons, icons and menus), participating in the movement of the content - from one session to another. The relationship can be characterized as non-linear, fixed and expandable, but it cannot be calculated. Relative to context, the content of the publication is more than what is offered in its space, with links and external contents. Moreover, because of the links presented, the context is considered hypermedia, having links that are built-in and parallel, internal and external, as well as complementary and related.

Communication of the publication takes place through the reader comments and media coverage sessions, sending an email to the author, in addition to other content and sharing pages (twitter). In this element, a one-to-one configuration (reader comments) and one-to-many (sharing on social networks) are provided as tools of communication.

According to Plos One, the media exposure extends article reach globally. The latest research summaries, author interviews, multimedia pieces, and other content are found in the section of Plos Research News.

### 2.3 Pub Pub

Pub Pub[3] is a free and open platform with instant publishing and continuously reviewed journals. The platform has been designed and developed by Travis Rich and Thariq Shihipar at the MIT Media Lab. The platform enables immediate author-driven publishing. Moreover, it provides versioned histories and collaborative open-source editing, that allows for evolving content and formats. Pub Pub affords support for dynamic assets and live visualizations. It is a tool built for and by the community. Furthermore, researchers are invited to code, design and contribute to improvements in the platform.

In relation to the the taxonomy of Paul [5, 6], the Pub Pub collaborative platform has the ability to provide tools for building a multimedia publication. The platform allows the users to insert media (static and dynamic) In this way, users can insert tables, static and dynamic images (gif), video, audio and other interactive resources. Along these lines, media content is visually asynchronous, the file is linked to the text and published only when the user chooses.

The action element in this platform concerns the actions for two distinct aspects: the movement of the publication contents itself and the action required by the user to access the content. The content is dynamic because it has the possibility to add animation in the publication. It is also static because the text does not move by itself. In regards to movement, it is active, the user manipulates the scroll bar so that the text moves down.

The relationship between the user and the content is non-linear, customizable, non-calculable, manipulative and expandable. For instance, content is customizable,

[3] Viewable in: https://www.pubpub.org/pub/about.

users have the possibility to edit their publications. The creator of the document and invited users may include external links, images (static and dynamic), videos, and references. In addition, there is the option to give feedback, make comments, highlight, etc.

Concerning the context of the platform, the publication is considered hypermedia. Inserting built-in links to external content, supplementary (references), contextual and related. Regarding the communication element and the ability to connect with others, Pub Pub has a one-to-one configuration such as feedback or emails, one-to-many (citing and following), and many-to-many (discussion chat) (Table 1).

**Table 1.** Result of the analysis.

| | Elsevier | Plos One | Pub Pub |
|---|---|---|---|
| Media | Static,<br>Dynamic (separately);<br>Multimedia;<br>Asynchronous. | Static,<br>Dynamic<br>Multimedia;<br>Asynchronous. | Static,<br>Dynamic;<br>Multimedia;<br>Asynchronous. |
| Action | Static;<br>Active. | Static;<br>Active. | Dynamic,<br>Static;<br>Active. |
| Relationship | Non-linear;<br>Fixed;<br>Customizable;<br>Non-calculated; Expandable. | Non-linear;<br>Fixed;<br>Standard;<br>Non-calculated;<br>Expandable. | Non-linear;<br>Fixed;<br>Customizable;<br>Non-calculated; Expandable;<br>Manipulative. |
| Context | Hypermedia | Hypermedia | Hypermedia |
| Communication | One-to-one | One-to-one;<br>One-to-many. | One-to-one;<br>One-to-many;<br>Many-to-many. |

## 3 Discussion and Conclusions

With the transition from print to online publishing, the layout and presentation of scientific publications have remained relatively unchanged in most publications, still following a static format with indications for interactive multimedia content. Based on Lancaster [7], one can say that electronic journals are in a third transition for the fourth stage of technological development, that is, they begin to be developed and distributed only in electronic media with incorporations of multimedia resources.

Meanwhile, a number of available enrichments on the scientific platform grows, these can provide variations in the intensity of their use, as it was measured in the analyzed platforms. Thus, it is based on the linear model of printed materials for its integration with multimedia using a more visual layout and directed to nonlinear reading.

The way these contents are being embedded into the publication is what to watch out for. The integration must consider the publication more visual, as the understanding of all of the scientific information within the publication is necessary to optimize the reading time, maintain publishing efficiently, and especially for increasing scientific

knowledge. Nonetheless, as analyzed on Elsevier, the multimedia content is processed separately as single objects that ends up individualizing the content, which could not be extended for other scientific publication platforms.

The platforms analyzed have multimedia enhancements, such as video, interactive graphics, animation, among others. Although these enhancements are expected to influence the acquisition of the knowledge embodied in the publication, they do not have the necessary interactivity to become more dynamic. In this way, interactivity is operationally defined as a purposeful action by the user, which causes a directional change or a meaningful response by the system with regard to the content. In essence, the dynamic action and interactivity would require the user to actively intervene in the process, capturing the user's attention and expanding the understanding of the content.

Scientific platforms must improve the content access for scholars and users, merely Elsevier and Pub Pub are customizable, and only Pub Pub is manipulative - for being a collaborative platform. The layout being customizable and manipulative offers a possible relationship between the user and the content. As the layout can adapt to the page according to the resolution being viewed, increase font size and images if desired, hide unnecessary elements in smaller reading devices, adapt button sizes and links, etc.

Through responsive design for user-centered approaches as the best way to create more effective learning tools, with effective and flexible access to materials which will, in turn empower them to make new observations and discoveries. Hypermedia systems are presented as a tool for the development of scientific communication - providing new alternatives of formats for scientific publications, adding interactive multimedia resources and non-linear content in scientific publication platforms.

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