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Open and commercial tools to generate a digital interactive story in journalism: systematic review and features analysis

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The constant technological advances are transferred to the area of journalism with significant contributions to the production of innovative formats adapted to the multimedia, interactive and multiplatform scenario. Since interactive narrative journalism is one of the trends of digital journalism, it is necessary to approach the offer of services that facilitate the journalistic creation of dynamic and interactive journalistic contents.The main objective is to analyze web programs and applications for the creation and publication of interactive digital narratives. Based on the PRISMA systematic review methodology, for the period 2015–2021, a total of 18 programs and web applications have been identified and analyzed for their value in interactive creation in digital journalism. This result came from the filtering of the advanced find of 1788 articles on 4 scientific database, from which were selected 28 final articles and of the filtering of direct find of 122 results on the google browser, from which were selected 58 webpages. 28 articles and 58 webpages sum 86 results which is the critical mass of data analyzed obtaining a total of 18 programs and web applications showed in this article. Five are open-source applications, which invite the community to continue developing improvements that make these tools innovative and adaptable to future changes. Our study reveals that there are highly valued functionalities, such as the capacity for data analysis and teamwork, among others that allow the integration of 360º multimedia, the management of the interaction map, the preview in different output formats, such as tablet or mobile. However, there is a lack of journalistic roles in these tools that let them coordinate and optimize the publication process to produce the final news.

Keywords: digital storytelling, interactive storytelling, interactive communication, technology, tools, digital journalism

1. Introduction

The range of tools that have been used throughout history to narrate a current event or to remember a past event is wide and varied, depending largely on the innovation and resources of the moment. The digitalization of journalism, with the arrival of computers in the newsroom and the consequent digitalization of production and products (Díaz Noci, 2001), initially required evaluating the conditions of the network to generate different products, which were fundamentally reflected in a basic development of hypertextuality, multimediality and interactivity of cyberjournalism (Salaverría & Díaz Noci, 2003). Technology has also forced us to redefine the processes and relationships between the media, journalists and audiences (Pavlik, 2000). With the progressive evolution of digital journalism, today with more than 25 years of history (Salaverría, 2019), we have seen how the media innovate in narratives through multimedia reports (Freixa, 2015), long-term digital formats (Hiippala, 2017; Planer & Godulla, 2021) of slow journalism (Le Masurier, 2016), interactive documentaries (Vázquez-Herrero & López-García, 2019), immersive narratives (Domínguez-Martín, 2015), and newsgames (Conill & Karlsson, 2016).

Regarding this scope our article has the following objectives as a starting point: (a) to identify the tools and web services that facilitate the production of an interactive digital narrative; (b) to classify the tools following the taxonomies proposed by Green et al. (2018) and taking into account the author tool classification framework by Shibolet et al. (2018). Therefore, we focus on the analysis of tools with the capacity to generate an interactive digital web narrative, of interest to the journalistic field.

These tools enhance the powerful of Interactive Digital Narrative (IDN) as a type of narrative for the transmission of knowledge. The literature shows different nomenclatures and terms used to refer to the IDN concept: interactive communication, interactive narrative, transmedia narrative, interactive journalism, digital storytelling, etc., as detailed in Annex I. Closely related terms, such as newgames, docugames and transmedia gamification, are highlighted (Paíno Ambrosio et al., 2017). IDN is a type of interactive content that generates much more traffic on digital platforms. An interaction that offers a paradigm shift, where the audience of digital media is at the center of it with a range of options that let them interact and go in deep in a dynamic way. Some authors remark the IDN role as the way to dissolve

the division between active content creator and passive audience (Koenitz et al., 2015). IDN changes the role of the journalist and the linear state of the news, allowing the reader to take an active role. The first and most successful attempts arose with infographics and another example is the case of Visual.ly, where the Marketing Director of Mint (Mifsud, 2011) states that the way in which digital media present information has been revolutionized. IDN is, therefore, an emerging field of study (Schustek García, 2019; Trillo-Domínguez & Alberich-Pascual, 2020).

Attempts to collect tools that focus their study on the generation of interactive narrative have covered from a simple list to greater efforts proposing classification frameworks as well as descriptors that allow the characteristics of the tools to be known (Green et al., 2018; Shibolet et al., 2018). Therefore, this article begins by using the PRISMA methodology as a method of systematic review, whose primary source is scientific databases and, as the results obtained in the bibliography are fewer than expected, it is complemented through direct search, which is explained in the next section. The results obtained are shown in section 3, which breaks down the main characteristics in Table 2, allowing us to delve deeper when these tools are paid (see Table 3) or open source (see Table 4). Some important characteristics like data analysis and teamwork which are really appreciated by journalists. Sections 4 and 5, with the analysis and conclusion, provide a range of useful information for journalists, which help them to have a prior opinion before finally opting for one tool or another.

2. Methodology

This review was performed following the PRISMA method (Page et al., 2021), which defines a protocol to guide the development of a systematic review of the literature and a meta-analysis of the documents selected in a sequence of tasks. It is, therefore, a useful methodology to identify, select, evaluate and synthesize studies.The databases searched were primarily Web of Science (WoS), Scopus, PubMed and IEEE Xplore. In addition, Google Scholar and ResearchGate were used as secondary sources. This first part of the search is represented in the left column of the flowchart under the heading “Identification of documents via scientific-academic databases and registers” (see Fig. 1). As a supplementary method and due to the novelty of the field of study, the direct search with the Google search engine has been

applied, as shown in the right column of the flow diagram under the title “Identification of documents via other methods” (see Fig. 1).

This PRISMA methodology has been implemented to identify, select, evaluate and synthesize studies, in which we expect to find either the tools and a detailed explanation of them or, alternatively, the case where they are applied in order to understand their usefulness, as occurs with Shibolet et al. (2018).

Searches were limited to the period 2015-2021, both years included, following the search strategy detailed in section 2.2. The inclusion and exclusion criteria are detailed for each method – PRISMA and direct search – in section 2.3.

2.1. Flow of steps of the systematic review.

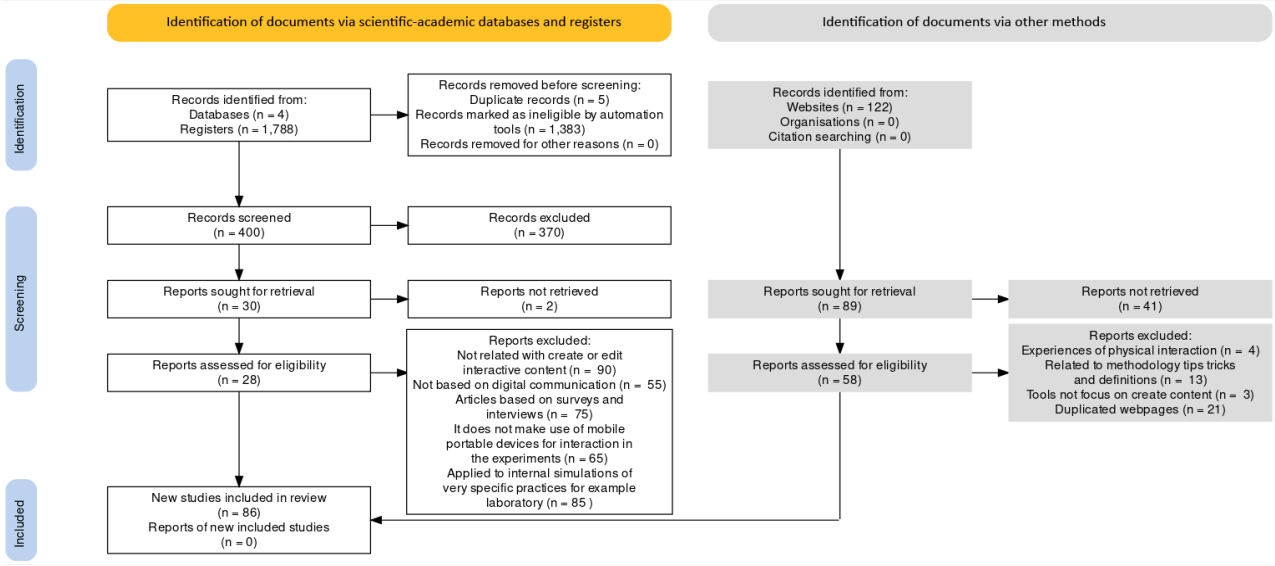

Figure 1. Data flow of the main results after applying the PRISMA methodology.

2.2. Search Strategy

We have started by applying the PRISMA method to four databases: WoS, Scopus, PubMed and IEEE Xplore. The objective of the search process was: (1) to find documents that address the creation of interactive content by digital means; (2) to identify any type of immersive technology, such as 360º video, virtual reality or augmented reality; (3) to make contributions related to the study of experiments or use cases in which the content created through storytelling or any of variants (for example, transmedia

storytelling, interactive journalism, etc.) were included; and finally, (4) the retrieved documents must include a description or direct reference to the tools used to generate such interactive content.

In accordance with the aforementioned requirements for the search process, a query was designed that consists of four blocks, which express those mandatory requirements. Each of the blocks is made up of several alternative but related terms (i.e., linked with OR), which together represent the main concept pursued by each block. To select the search terms, different iterations are carried out, which allow a greater adjustment to each identified search requirement. As a result of this process, the final query is obtained:

```
(video OR 360 OR html5 OR java* OR jquery OR "virtual reality" OR "augmented reality") AND (interact* OR edit* OR responsive) AND (journal* OR "social media" OR educa* OR "news") AND ("content creator" OR journalist OR teach*) AND (storytelling OR experiment OR event)
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The query allows us to obtain an initial selection of articles for this review, from which the references whose eligibility criteria are described in section 2.3.1 and section 2.3.2. These filters has allowed us to obtain 28 articles (November 2021) which were retrieved and verified.

As a last step, a direct search was carried out with the Google search engine (December 2021), with the aim of expanding the tools and web services found with the search query "tool for creating digital interactive content". The results with this last step and applying the inclusion and exclusion criteria (section 2.3.3 and section 2.3.4) have increased the tools for the in-depth review by 58. The total of 86 is the sum of the articles and tools located, to which a final filter of exclusion criteria is applied (section 2.4.1).

2.3. Eligibility Criteria

2.3.1 Criteria for inclusion of scientific articles

Only those results that were categorized within the databases have been included, such as:

(1) articles;

(2) published between 2015 and 2021, both years included;

(3) no filters have been applied to the knowledge area;

(4) language: English or Spanish;

(5) only open access documents.

2.3.2 Criteria for exclusion of scientific articles

Reviewing the articles that have been obtained once these filters have been applied, we have discarded those works that are:

(1) not related to creating or editing interactive content;

(2) not based on digital communication;

(3) articles based on interviews or surveys that did not show experiences with open or commercial tools;

(4) documents in which mobile, portable devices are not used for interaction in the experiments and therefore do not guarantee that the tool will be accessible to creators or readers on-the-go;

(5) about tools applied in very specific internal simulations, for example, in a laboratory.

2.3.3 Criteria for the inclusion of tools by direct search.

Only results following these criteria have been included:

(1) published between 2015 and 2021, both years included;

(2) about interactive digital tools for creating content;

(3) integrated development environment for the Web.

2.3.4 Criteria for the exclusion of tools by direct search.

As a consequence of the results obtained from the direct search with the Google search engine and applying these filters, we have discarded those results that:

(1) are based on experiences of physical interaction;

(2) are documents or websites about methodology, functionalities, tips and even defining interactive storytelling is discussed, but tools are not mentioned;

(3) are content containers or tools only focused on publication and dissemination of other programs or services such as CMS (Content Management System);

(4) are duplicate records.

2.4. Selection process

In a first selection phase within the PRISMA method, we screened the papers based on their relevance in relation to the proposed research objectives. For this selection, titles and abstracts were checked inaccordance with inclusion and exclusion criteria. The article was marked as a candidate for the next phase in case of doubts with the decision. Next, in the eligibility phase, the manual review of all the works that passed the selection phase was considered.

The search process was complex from the beginning of the creation of the query, which is why more than 10 iterations have been needd, having observed that the results obtained were as expected. Finally, the aforementioned query has been applied to obtain a total result among the four databases of 1,778 found articles, of which only 400 have been incorporated into the screening process after filtering –1383 were excluded by the criteria of section 2.3.1–. Finally, the screening has resulted in the exclusion of 370 articles for the reasons described in section 2.3.2, to proceed to the in-depth review of 28 articles.

In a second selection phase, as a result of the direct search, other resources have been identified: 122 relevant results have been found, applying the inclusion criteria. Of these, 89 have been added to the screening process after filtering –33 excluded for being graphic resources–. Finally, in the screening, 41 results were excluded due to the criteria described in section 2.3.4, having passed 58 documents to the in-depth review.

The final set of documents and tools to be reviewed is, therefore, 86. Within these results we have found programs and web services which should not be included in this review for the reasons described in the following section 2.4.1. And so, the final number of tools incorporated in the review is 18, which are shown in Table 2.

2.4.1 Causes of exclusion of tools.

- Non-cross-platform application or service. Some services or programs have specific characteristics for a single operating system, which is outside the object of study. We focus only on digital media, mainly web, that seek interaction through the net.

- Discontinued application or service. It is common for services or applications to go unsupported –as is the case with Metta (metta.io)– as they evolve to new tools adapted to the most recent needs of the market, with a direct interaction on the digital platform adding videos, photos, and content. Such is the case of Yourhub.com 2009, a project launched by Rocky Mountain News and The Denver Post, whose objective was to promote communication with content created by their own staff or others (Moozakis, 2011).
- Application or service that does not allow publication. To show the individual results of an interactive story, some products do not allow publishing through the web, since some tools restrict viewing to PCs or tablets.
- Applications or services that only allow work in the pre-production or design phases of the news. This is the case of those web editors that allow interactive wireframes to be reused in interactive journalistic pieces, for example Figma (2016), UXPin (2010), Adobe XD (2015) among others. Only those that have the capacity to publish the project or story are included.
- Application or service that needs to be installed on the computer. This feature is advantageous for internal performance reasons, but in the case of constant updates it implies costly hardware structural changes. That is the case with Korsakow, developed in Germany by Florian Thalhofer and Matt Soar (Thalhofer & Korsakow, 2000), the French tool Klynt, from Honkytonk Films, and Eko, developed by Yoni Bloch's American-Israeli team (Berga et al., 2018).
- Application that does not integrate with videos. In these cases, the purpose is more focused on reading and writing and not on publishing – Wattpad allows the creation of stories, but its functionality is limited to allow users to read and write.
- Incomplete application or service. Some services such as Timeline JS (Knight Lab, 2009) do not cover creating different types of IDN. However, we consider it of interest for the media and journalists, so they are shown in Table 1.

Category	**Name**	**URL**
360º image	Scene	scene.knightlab.com
Audio recording	Audacity	audacity.es

Image gallery	Slices	slices.co/services
Image map	Pictogon.com	pictogon.com
Interactive image	Juxtapose	juxtapose.knighlab.com
Interactive map	Carto	carto.com
	Flourish	app.flourish.studio
	MapHub	maphub.net/map
	StoryMap	storymap.knightab.com
Maps	Google Maps	maps.google.com
	Mapme	mapme.com
Monitoring	SensorGrid	sensorgrid.knightlab.com
Timeline	Storyline	storyline.knightlab.com
	TimelineJS	timeline.knigthlab.com

Table 1. Libraries and complementary web services that give value to IDN.

3. Results

The results have been obtained from 18 applications or web tools that have the ability to generate interactive digital narrative (see Table 2) and are studied in this section with the aim of, not only identifying them, but also helping their understanding through classification, taking into account taxonomy proposals from authors such as Green et al. (2018) and Shibolet et al. (2018). The results are also broken down into two tables, one showing the commercial tools (Table 3) and the other with the open source tools (Table 4).

Regarding the categories proposed by Shibolet et al. (2018): (a) flexible game engines, for example Unity 3D (2004) or Unreal Game Engine (Sweeney, 1998); (b) genre game creators such as RFGMaker (ASCII et al., 1992) or Adventure Game Studios (Chris Jones, 1997), they are discarded because are not based on web applications. They are therefore generative tools, whose end products are entirely code-based, intended to be played on a computer or console, ranging from text to real-time graphical rendering, and categorized as follows (Shibolet et al., 2018).

Name	URL	Responsive	Open source	Original field	Multimedia 360º	Interactions Map	Collaborative	Devices Preview	UI Friendly	Data Analytics	Gamification
Apester	apester.com	Yes	No	Marketing	Yes	No	No	No	Good	Yes	No
Canva	canva.com	Yes	No	Education / Marketing	Yes	No	Yes	Desktop	Good	Yes	No
EducaPlay	es.educaplay.com	No	No	Education	Yes	No	No	Desktop	Bad	Yes	Yes
EkoStudio	studio.eko.com	Yes	No	Journalism / Marketing	No	Yes	Yes	Desktop / Tablet / Mobile / QR	Bad	No	No
ExplainEverything	explaineverything.com	Yes	No	Education / Marketing	No	No	Yes	Desktop	Good	No	Yes
Genially	genial.ly/es	Yes	No	Education	Yes	No	Yes	Desktop	Excellent	Yes	Yes
H5P	h5p.org	Yes	Yes	Education	Yes	No	No	Desktop	Excellent	Yes	Yes
Inklewriter	inklewriter.com	Yes	Yes	Journalism	No	Yes	No	Desktop	Bad	No	No
ION	ion.rockcontent.com	Yes	No	Marketing	No	No	Yes	Desktop / Tablet / Mobile	Good	Yes	No
Korsakow	korsakow.com	Yes	No	Education / Research	No	No	No	Desktop	Bad	No	No
Pageflow	pageflow.io	Yes	Yes	Education / Journalism	Yes	Yes	Yes	Desktop / Mobile	Good	Yes	No

RacontR	racontr.com	Yes	No	Journalism/ Marketing	Yes	Yes	Yes	Desktop / Tablet / Mobile / QR	Good	Yes	No
Stornaway	stornaway.io	Yes	No	Marketing	Yes	Yes	Yes	Desktop	Good	Yes	No
Storyplaces	Storyplaces. soton.ac.uk	No	Yes	Journalism	No	No	No	Desktop	Good	No	No
Thinglink	thinglink.co m	Yes	No	Education	Yes	No	Yes	Desktop	Excellent	Yes	No
Twine	twinery.org	No	Yes	Education	No	Yes	No	No	Bad	No	No
Visually	visual.ly	Yes	No	Journalism	No	No	Yes	Desktop / Tablet / Mobile	Good	Yes	No

Table 2. Programs and web applications for the creation of interactive content in digital journalism.

Since 2011, some of these tools have already partnered with major digital media companies such as The Atlantic, Buzzfeed, CNNMoney, and National Geographic, among others, to provide them with infographics and data visualizations (Mifsud, 2011).

Regarding Table 2, we can affirm that the collected tools allow journalists to create interactive digital narratives. The functions such as: collaborative work, map of interactions, and data analytics, offered by each of these tools are also shown in order to facilitate the choice of one or the other according to the needs that the story or publication demands. It is important to highlight that the tools are constantly updated. The objective of this update and improvement is motivated by the desire of not falling into disuse and at the same time to monitor the competition, offering more options to the professional content creator. The appearance of new multimedia models such as videos and 360º images entail functionalities that will be incorporated into applications that currently do not offer them.

A common feature of these tools is that they use HTML, HTML5, CSS or JavaScript as navigation languages that are interpretable by any browser: a combination of markup language (HTML and HTML5), style or layout languages (CSS) and language that provides features such as transformation, rotation and animation (JavaScript). However, the programming language used to generate these tools is not always openly offered by the founding companies, as it is confidential information that may threaten the security or stability of the product or due to commercial interests. Therefore, with the exception of free software tools which publish repositories and therefore the way of generating new modules or personalized adaptations, as is the case with Twine (Klimas, 2009) and Pageflow (SilverStream Software, 2014) (see Table 4), few private companies make this sensitive information public.

The most common and significant functions in order to cover needs within the generation of interactive digital narratives in news media outlets are detailed next.

- 360º multimedia integration (image and video). A functionality that allows you to create virtual tours or place compositions so that these contents can be viewed both by mobile in VR mode (magic window) and by HMD (head-mounted display) glasses, providing news with an immersive component that gives the reader or consumer of the story an empathy and closeness

to the narrated events. This is the case of H5P (Otero González, 2022; Team & Tromsø, 2013) or Genially (Rubio et al., 2014; Roldán, 2019).

- Management of the interaction map. This functionality has special relevance, as it allows us to control the different paths of the news from its beginning to its end, going through the different conditions that divert us towards one alternative or another. The global vision of the map, as well as going to the detail of each bifurcation are very useful for the journalist, both working in isolation and collaboratively as a team. It is therefore a key factor in the distribution of collaborative work tasks, cocreation of news and can be seen in tools such as, Ekostudio (Interlude US, 2011), Inklewriter (Inkle, 2011).
- Collaborative work. Inviting more journalists to contribute to the development of an interactive news that brings more strength to it, not only in manpower for the elaboration of the story, but also different perspectives that enrich the story. The majority of tools incorporate this feature.
- Preview on devices. It is very common for tasks, where the dissemination or publication is distributed in media as different in format as size as a computer, tablet or mobile screen, to have the functionality to preview or simulate the content. Many of the tools displayed in Table 2 offer this, allowing you to choose, for example, between desktop, tablet, and mobile preview. Some even give the option of scanning a QR, as in the case of Paperflite (Sales Enablement Software, 2016), to check this display on the desired device. Preview is a very useful function that gives the professional the ability to see the final product and test the interactions and check if these are the ones expected to be found. A role associated with this function is that of the product quality department, which consists of testing a final product with the functions expected of it before it is released to the public: a way to check that the news project has the use we expect depending on the device.
- Friendly environment or UI. It is very important that the navigation through the news editor is well taken care of and that it offers good integration with other functions or capabilities. Three levels have been proposed for this table [bad, good, excellent]. These levels range from poor navigability due to the unclear elements that identify the functionality and how to implement

it, to excellent, where the paths to implement a function or add an interaction are multiple and clear, both to integrate and to obtain an expected result.

- Data analysis. The object of study of this article, interactive digital narratives as a visual format in the news, is enriching in terms of data that consumers generate when browsing the news, as well as the interactions or alternatives chosen. Therefore, they offer a heat map of the user's activity on the published news.
- Gamification. A feature that manages to retain and engage the user in the news. The fact of reaching achievements or playing a role defined by the journalist with the objective of understanding all the points of the problem to be told is a way of immersing the user in the story.

In addition to the functions described above, the way in which the story is built is useful and important. The generation of content based on forms such as GAIA (Kim et al., 2011) and NM2 (Ursu et al., 2007) is a mode popularly implemented in the first tools of this interactive style. The reality is that today 'drag and drop' is the most common way of working. The UI is a space where the interface is built like a 'lego' and the elements that are embedded are associated with interactions, which allow saving the action associated with the different alternatives on that button by means of a checkbox or indicating the variable, such as in Racontr (2011), EkoStudio (Interlude US, 2011) and Storyplaces (Bolter et al., 2015), among others.

Regarding the phases in which these tools are used, the publication phase stands out as an essential and common element where the journalist already has all the materials prepared to fit them into a story which, with the help of these applications, becomes an interactive story of interest to any user. Only some of them include previous design steps with the combination or change of colors or shapes such as Pixton and H5P, among others, and also include review or testing phases with preview in different formats, such as PC, tablet and mobile screen, to check that the result is as expected.

Name	Price / month	Funded	Country	Delivery Methods	[7] SSO Access	Collaborative Editing	Downloable
Apester	($39.00 - $529.00)	2014	Israel	Web-based	Yes	No	No
Canva	(9,16€ - 112,00€)	2012	Australia	Web-based / Standalone	Yes	Yes	Windows / Mac / Linux / Android - IOS App
EducaPlay	(4,00€ - 39,00€)	2017	Spain	Web-based	Yes	Yes	No
EkoStudio	Not available	2010	New York & Tel Aviv	Web-based	Yes	Yes	No
ExplainEverything	($6.99 - $11.99)	2011	Poland	Web-based / Standalone / Integrated	Yes	Yes	Android – IOS App [8]
Genially[1, 2]	(7,49€ - 79,15€)	2014	Spain	Web-based	Yes	Yes	No
ION	Not available	2013	Brazil	Web-based / Integrated	Yes	Yes	No
Korsakow[5]	($7.50 - $299.00)	2000	Germany	Web-based	No	No	No
RacontR	Not available	2011	France	Web-based / Standalone	No	Yes	No
Stornaway	($15.00 - $90.00)	2019	Great Britain	Web-based	No	No	No
Thinglink	($20.00 - $125.00)	2010	Finland	Web-based	Yes	Yes	Android – IOS App [8]
Visually	Not available	2013	USA	Web-based	No	Yes	No

Table 3. Paid web applications and services for the creation of interactive content. [1] Those programs or services that allow users to use the free version of the tool for a limited time (freemium). [2] It has special prices for the educational sector. [3] The premium version has a free license to use. [4] Limited to the creation of only one free timeline. [5] From 2010 to 2015 the application was released as free software. [6] Allows publishing for free but with limitations. [7] SSO (Single Sign On). [8] App (Mobile Application)

Although some of these applications are initially distributed with free licenses, the current trend is to limit this use of the service intime. This policy is motivated in part by the heavy load of users signing up for these services, as well as the need to adapt the software by professional teams to the rapid technological evolution. This is the case of Korsakow (Thalhofer & Korsakow, 2000), an application created by Florian Thalhofer as a product of his research on alcoholism, taking its name from Korsakoff's syndrome itself. This service, which was free between 2010 and 2015, now has a premium version whose initial price is approximately 290 euros. Several scientific articles have mentioned this tool (Miles, 2014; Sarkissian, 2010).

The set of services analyzed in Table 3 is around 10 euros for the individual version and 80 euros for the teamwork version with several users. It also affects the space needed for storage, as well as the contracting of training services or the design of specific parts that are not included in the costs of use by the application.

With some applications, such as RacontR (Grégoire, 2011), the solution originally had dissemination purposes within the journalism sector and is currently used by very diverse content creators: web agencies, large media (France Télévisions, Les Echos, Paris Match), companies (Orange, INA, Textuel La Mine) and NGOs (Greenpeace, Solidarités International).

As an alternative to paid applications, there are some resources that are open source (free code), such as those shown in Table 4.

Name	Licence	Repository	Current support	Community	Programming Language	Initial Release	Stable Release
H5P [1]	MIT	github.com/h5p	Yes	Big	HTML5 / JavaScript	2013	V 1.0.3 11 June 2021
Inklewriter	GNU/GPL v3	github.com/inklewriter/freeinklewriter	Yes	Medium	JavaScript	2012	V 0.13.0 15 June 2022
Pageflow [1]	MIT	github.com/codevise/pageflow	Yes	Medium	Ruby	2014	V14 23 April 2019
Storyplaces	GNU/GPL v3	github.com/storyplaces	Yes	Small	TypeScript	2009	v2.3.16 11 May 2021
Twine [2]	GNU/GPL v3	github.com/klembot/twinejs	Yes	Medium	V1.* Python V2.* TypeScript	2009	V 2.3.16 11 May 2021

Table 4. Open source web applications and services. [1] It has a paid version that offers teamwork features in the cloud. [2] There are two versions, one created in TypeScript version 2 and the other in Python version 1.

A list of applications that are currently supported is presented, clearly indicating the central repository on which both the founders themselves and those who are within the developer community work. This is an open community that feeds back, which is a fundamental pillar of open-source tools and which serves as the basis for new challenges when creating interactive digital content.

4. Analysis

Sectors such as journalism, unlike other industrial sectors, were slower to introduce new techniques such as interactive storytelling (Schustek García, 2019; Trillo-Domínguez & Alberich-Pascual, 2020)or artificial intelligence (Otero-González, 2022). But the awareness that technological advances in any area are the engine of transformation has made them try to jump on the bandwagon that allows them to experience innovation. The official dates on which the organizations and companies that created these tools were founded clearly indicate a period from 2006 to the present, but their great expansion began in the second decade of the 2000s.

Among other innovations, digital narrative is a preliminary step to a more dynamic and attractive narrative, such as IDN. This product, created from the analyzed tools, introduces all the

multimedia elements known to date, including the innovative 360º videos and photos, which provide the immersion factor typical of virtual environments.

The acceptance of this type of format by users of digital media such as The Telegraph, The Huffington Post or The Times (Cohen & Tzadok, 2019) is arousing interest from other digital media at a global level when it comes to implementing this type of more attractive resources (Vázquez-Herrero & López-García, 2017; Vázquez-Herrero, 2022). In addition, these services or web applications provide added value by offering the convenience of publishing in the language of the user reinforcing internationalization strategies.

The reflection in the analyzed results of available tools for the creation of interactive digital narrative is the possibility that these offer journalism professionals the ability to create dynamic resources, adapted to new devices such as tablets or mobile phones. The largest visual component with explanatory images and videos is a fundamental part of the functionalities they offer, adding interaction that allows the user to take control of the story.

These interactions and the different alternatives that users choose about the story are considered by more and more tools, some of which are shown in Table 2 Pageflow (SilverStream Software, 2014). The relevance of the analysis of these data has been valued very positively by many authors (Appelgren & Jönsson, 2021; Chang et al., 2018), being a source of feedback for improvement that objectively reflects consumer behavior and enriches the professional in the generation of new stories.

This functionality of data analysis is highly valued, as well as the fact that it allows collaborative work, especially in stories where the participation of several professionals is essential. On that point, it remains to define in what role the professionals intervene and translate it into the tools with certain permissions that grant greater or lesser responsibility. That is, generating role distribution profiles for the generation of content in the tools is a shortcoming that is not covered for the time being by any of the tools analyzed. Thus, for example, the editors, reviewers, layout designers and testers, who are necessary roles that interact to publish content, need to be coordinated with these tools, by means of different permissions which do not negatively affect the work of the other roles.

Within the news paradigm, it is always made up of fixed elements, title, narrative, images, which make up a story with a short life cycle, which transcends depending on the relevance of the news.

However, the analyzed tools allow the creation of live products beyond the pure interaction that gives control to the user. These products can become live projects that vary and enrich themselves, creating news that is constantly changing and evolving. This implies that the news becomes a narrated project where an evolution over time is offered, and it is adapted and enriched with the progression or resolution of the news itself.

5. Conclusions

Beyond the topicality and relevance of a journalistic piece, there is the medium through which it reaches the audience. Hence the importance that we want to give this work as a way to make known the range of tools that exist to help emphasize and reinforce interactive storytelling in journalistic publications, through programs or web services that cooperate in capturing an active community of readers. The need to offer accessible news from any device leads publishers to greater digitization and adaptation to a more visual user, who wants to take control through interaction of touch screens.

The contribution of this research is, therefore, the collection and analysis of applications, programs and web services focused on the creation of interactive content. It generally affects content creators and journalists, especially due to the relevance of these resources in the development of digital skills of the new professional profiles in journalism (Reyes-de-Cózar et al., 2022).

An interesting finding is the need to incorporate a wider range of user roles than those included or involved in the news publishing process, such as the coordinator and manager of these projects, as there is a lack of journalistic roles in these tools that let them coordinate and optimize the publication process. In addition, the role of the professional in the data collection and analysis process is poorly supported by the vast majority of the tools analyzed. Both factors are highly valued by the communication community in digital media.

Many authors agree in naming these interactive digital tools, which generate narrative, as ‘authoring tools’: a concept that brings together those tools that simplify and facilitate the process of generating interactive content with a friendly and intuitive UI, without the need for programming or computer skills. Under this authoring tools umbrella, the tools analyzed and displayed for the benefit of content creation in digital communication are classified in the results section.

For future research, additional objectives are set out below, which we understand are of interest to the community:

- to carry out comparative experiments of the tools in practical cases and evaluate the solvency and learning curve necessary for the creation of content;
- to expose through periodic publications some of the capacities, both new and essential, that demonstrate the functionalities that are offered to the community;
- to track the tools collected in order to update, especially those that stop providing services or become discontinued by the community and the founders; for example, this is the case with Capzles, Metta and Storify.

One of the difficulties of the study is that scientific publications are far behind the market and that it is a field of rapid evolution that remains alive. However, there are reasons to believe in the benefits and strengths of this contribution to interactive multimedia journalism, as a point of reference and consultation for experts and beginners in the present digital age.

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Annex I. List of keywords and search terms related to interactive content

The keywords are: spanish (sp) "contenido interactivo" / english (en) "contenido interactivo", (sp) "documental interactiva" / (en) "documental interactivo", (sp) "ficción interactiva" / (en) "interactivo ficción", (sp) "narrativa transmedia" / (en) "narrativa transmedia", (sp) "periodismo interactivo" / (en) "periodismo interactivo", (sp) "redacción interactiva" / (en) "escritura interactiva" , (sp) "relato o cuento digital" / (en) "storytelling".

Spanish	**English**	**Language in which the concept is more frequent**
ciberperiodismo	cyber journalism	English
contenido interactivo	interactive content	*Spanish*
cuento interactivo, relato interactivo	interactive story	English
comunicación interactiva	interactive communication	*Spanish*
documental interactivo	interactive documentary, i-doc	English
factual interactiva	interactive factual	English
ficción interactiva	interactive fiction	*Spanish*
juegos de narrativa interactiva	interactive storytelling games	English
lenguaje audiovisual interactivo	interactive audiovisual language	English
narrativa de datos interactivos	interactive data narrative	English

narrativa digital	digital narrative	English
narrativa digital interactiva	interactive digital storytelling	English
narrativa transmedia	transmedia narrative	*Spanish*
periodismo interactivo	interactive journalism	*Spanish*
periodismo electrónico interactivo	interactive electronic journalism	English
periodismo interactivo multimedia	multimedia interactive journalism	English
redacción interactiva	interactive writing	*Spanish*
relato o cuento digital	digital storytelling, storytelling,	English
relato o cuento visual	visual storytelling	English