Many Short Links

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MANY SHORT LINKS

The influence of the quantity and size of links on user behaviour, perception and comprehension

Félix Arias-Robles and **José Alberto García-Avilés**

Navigating the internet is transforming the bases of news consumption. These changes, thoroughly analysed within some technical areas, still raise questions about the reception of news content. This study explores the influence of the quantity and size of links on user behaviour, perception and comprehension. The experimental analysis, carried out using a convenience sample of 170 individuals, with six different model websites, reveals that content with both a greater number of links and with shorter links yields better results in terms of levels of perception, comprehension and, above all, user behaviour.

KEYWORDS   comprehension; digital journalism; hypertext; perception; reception; user behaviour

Introduction

Hyperlinks form the basis of most digital environments. With the advent of the World Wide Web—the first big practical demonstration of hypertext—hyperlinks have become a familiar and transparent feature to users. Their impact continued to reverberate with the arrival of the Social Web, which allowed anybody to insert links, and the Semantic Web, which enabled the interconnection of information (Berners-Lee 2006, 10–14). Phenomena such as multimedia, interactivity and information architecture require the interconnection of a series of fragments through hyperlinks, although their most advanced manifestations are probably now found in the so-called "new narratives": data visualisation, webdocs, immersion and gamification (Bogost, Ferrari, and Schweizer 2010, 4–12).

Nevertheless, much remains to be investigated about the influence of these phenomena on content reception, particularly news content (Doherty 2014, 124). Academia has shown interest in the relationship between the digital world, journalism and language but, on occasions, hypertext has been studied under other denominations and not always with the necessary depth or rigour (Azevedo and Jacobson 2008, 96).

In this context, journalistic research into the user has been relegated to second place, as academics until now have focused on analysing contents and media outlets.

When attention has been paid to the reader, research has all too often tended towards theoretical discourse or general studies on readership. The absence of primary data and empirical research is a common feature of most studies on user behaviour, which usually rely on secondary sources, such as market surveys and statistics. Also, some studies of reception have been limited to applying an ethnographic qualitative perspective, mainly based on the observations and accounts of the subjects themselves (Domingo 2006, 119).

It would, therefore, be useful to apply empirically based techniques that go beyond debate and simple theoretical examination—even if, as in this case, it is only exploratory in nature—because if phenomena such as the interaction of users during navigation and reading are analysed, the design of hypertexts can evolve. Moreover, digital journalism, now more than ever, has to consider the user, which "requires not only a specific sense of reader interests, but a more general, theoretical understanding of user expectations and information-seeking strategies" (Huesca and Dervin 2003, 282).

With this in mind, this study analyses the influence of hypertext on behaviour, perception and comprehension of news content, these being the most relevant variables included in most reception studies (Moos and Marroquin 2010; Richard and Chandra 2005; Zumbach and Mohraz 2008). Specifically, the number of links on the node of origin and the size of hyperlinked text are examined. The investigation starts from the hypothesis:

> **H1:** The number and size of links influences readers' behaviour, perception and comprehension of online news.

This has been substantiated by some studies (Ignacio Madrid, Van Oostendorp, and Puerta Melguizo 2009). However, the nature of this influence and its weight on how news content is consumed has not been explored deeply enough. Especially, if we take into account that how readers perceive and understand the news has an effect on the efficiency of the journalistic content and, eventually, on its profitability.

Previous studies have often reached contradictory results. Therefore, with the basic premise that balance in the text is a solid principle, we hypothesise:

> **H1a:** Pieces with a moderate number of links and nodes positively influence reader behaviour, perception and comprehension.

> **H1b:** Pieces with medium-sized links positively influence reader behaviour, perception and comprehension.

These hypotheses are built on the premises that hypertextuality has become a daily phenomenon, which has been assimilated by users, especially younger ones, who value the advantages of using hyperlinks. They also assume that hyperlinks' use has to be moderated, using medium-sized links in order to favour the reception of news content.

The New Journalistic User

Research about hypertextuality in journalism has increased in recent years. The most abundant studies are still those which analyse the presence of links in the news. In this regard, it is worth noting the findings by authors like Coddington (2012), who

compares the uses of these elements in blogs and news sites, and Karlsson, Clerwall, and Örnebring (2015), who delved into hyperlinking practices in Swedish online media.

Other articles have focused instead on the assimilation of hypertextuality by journalists. Vobič (2014) discussed the actual use of the links in two Slovenian media through observation, De Maeyer (2012) compiled prescriptive discourses about this phenomenon both in journalism textbooks and journalism educators, and Coddington (2014) examined the creation of linking norms among political bloggers and professional journalists through in-depth interviews.

Several authors have interpreted the consequences of using links in journalism. Weber (2012) took a closer look into the long-term implications of hyperlinking in newspapers. Ryfe, Mensing, and Kelleyc (2016), 52–53) showed that links are changing the form of news stories in four main areas: navigation, citational, social and commercial. According to these authors, most links allow users to move easily along the text, and also increase news credibility through attribution, improve content distribution and even facilitate generating income.

The content and the sender of digital news have undergone extensive and solid research. However, there are significant gaps in the study of the user, especially about how linking influences the reception. Most of these advances, as noted below, have been produced in fields such as computer science or psychology.

New Routes of Information

One of the main innovations in digital consumption has been the ability to measure user behaviour (Chisholm 2010, 17–18), which has enabled the planning, design and optimisation of interfaces (Sohn and Choi 2014, 868). Creating hypertext structures requires precise knowledge of user behaviour (Pope 2010, 91) and also requires data about users' navigation, perception and understanding of the contents they consume to be obtained.

Journalism, however, has tended to ignore user feedback because of the difficulties in identifying its readership and the self-imposed barriers put in place to protect independence (Tandoc 2014, 563). Certain media outlets believe that Web analytics are a useful way of studying the reader and determining news organisation (Lee, Lewis, and Powers 2014, 521). However, most studies on news consumption have displayed certain limitations, such as the separation between the print press and online media (Mitchelstein and Boczkowski 2010, 1086). Also, many media have been slow in using the potential of hypertextuality (Karlsson, Clerwall, and Örnebring 2015, 858), mainly due to management issues (Günther and Scharkow 2014, 524–525).

Although usually from the perspective of Web design, most studies confirm that links are the key to navigation. It is considered that the urge to click is one of the main differences between analogue and digital readers (Mangen 2008, 410), so that links should be placed where users expect them (Grahame, Laberge, and Scialfa 2004, 396). According to Hargittai:

> Links play a crucial role in how attention is allocated to the material online, in what kind of content becomes popular, and in what information is seen only by a few peo-

ple. Links help users meet everyday needs, ranging from the trivial to the profound. (Hargittai 2008, 102)

Much research has focused on explaining the causes of users' behaviour. When navigating, the user usually clicks on a link or carries out a search (Ignacio Madrid, Van Oostendorp, and Puerta Melguizo 2009, 66). However, in both cases the motives behind navigating determine user behaviour (Prabu et al. 2007, 181). Those who have specific goals require greater cognitive resources (Di Stasia et al. 2011, 303). This undoubtedly has an impact on media consumers, when users wish to satisfy specific needs. Therefore, links play a key role in multimedia consumption, as Rodríguez argues:

> The hyperlinked acts of consumption that online audiences typically carry out while navigating Web portals have altered the manners through which audiovisual products address consumers. Media contents display a propensity towards the intertextual citation of other texts and the re-combination of selected sounds and images. (Rodríguez 2014, 161)

The increase in hypertext, therefore, has resulted in a rise in multitasking and changes in user strategies (Nass 2010, 11). The user now has greater opportunities to interpret information and, therefore, to select and distribute the links leading to it (Johansson 2014, 32). The customisation of media content reception allows users to optimise the time they dedicate to news consumption (Beam and Kosicki 2014, 71–72). Links usage has therefore changed the patterns on multimedia and multitasking news consumption, where new journalistic elements are required. The media can no longer remain ignorant of changes in user behaviour, which can be measured with more precise tools than ever.

The Transformation of Perception

Users' subjective feelings condition the attention they pay to news and, therefore, the ability of news to influence them. However, this influence becomes even more important when reading hypertext, as it changes in line with a user's particular experience (McEneaney et al. 2009, 36–37) and causes the user to feel active. For online narratives, format exercises a notable influence on aspects such as attitudes, cognitive responses and empathy (Shen, Ahern, and Baker 2014, 108–109).

Some authors, again not from journalism research, have analysed the influence of behaviour on the user's subjective perception. According to Richard and Ramdas (2005, 1027), interactivity positively affects attitudes towards the internet. Lee, Heeter, and LaRose (2005, 21) found that it encouraged curiosity, especially when carried out in groups. Moreover, Redish (2007, 3) concluded that most users are trying to satisfy a practical need rather than reading for fun.

Hypertext also positively influences so-called "situational" interest experienced by readers when they come across content unintentionally (Yaros 2011, 279). Interest, which is also associated with motivation, is a decisive factor in multimedia and hypertext reading (Moos and Marroquin 2010, 270–272). For hypertext products, therefore, trust and content appeal are essential (Weinschenk 2009, 13–25), as are factors such as enjoyment, reward, similarity to what the reader already knows, emotion and engagement (Nabi and Krcmar 2004).

In the journalistic field, credibility has received increasing attention. It has been found that the credibility of a news website depends on its usability, transparency, customisation, professional appearance, usefulness, accuracy, partiality and authorship (Das and Pavlíčková 2013, 393; Fogg et al. 2002, 31). According to Canavilhas (2008, 204–206), hypertext improves a website's credibility and readers' sense of satisfaction, especially among more experienced users, as it provides them with a greater sense of control. The presence of links increases readers' trust in the news, as it boosts content processing (Borah 2014, 586–588) and favours credibility (Chung, Nam, and Stefanone 2012, 182).

These studies about credibility should be completed by analysing which specific factors influence this perception; and, above all, they should be completed by introducing other variables such as interest or comfort, which are essential for the success of any journalistic product.

Assimilating Fragmented Contents

Comprehension, understood as the process of interpreting and assimilating new information (Anderson and Pearson 1984), is associated with one of the essential functions of journalism, keeping the public informed. Comprehension of hypertext is divided into two levels: at the local level, the reader understands the information present on each page; at the global level, the reader has to integrate all the pieces into a single, coherent unit (Lacroix 1999, 231). The Cognitive Model of Web Navigation established four processes in navigation: the division of content into regions, focusing the attention on one of these, the comprehension of its key elements and the selection of the most appropriate one (Aggarwal and Van Oostendorp 2012, 1).

Early research, which focused on navigation and orientation variables, concluded that linear texts were understood better than hypertext (Wang 2003, 5–6). Mark Tremayne (2008, 704), however, called into question many of these conclusions due to deficiencies in the design of the models and participants' lack of familiarity with the internet. Later experiments demonstrated that, as users and designers gained more experience with the internet, problems associated with disorientation decreased, while users with prior knowledge about what they were reading gained better results (Gurlitt and Renkl 2010, 419; Rouet and Le Bigot 2007, 167).

Other determinants of hypertext reading lie in content presentation. Users have to understand the relationships between the interrelated elements (Urakami and Krems 2011, 294) and contents need to be integrated well (Vörös, Rouet, and Pléh 2011, 2053–2054). Information visualisation is extremely important in making learning and understanding easier (Salmerón et al. 2010, 424–425; Schnotz and Heiß 2009, 371–378). Reading order and the quantity of information also have considerable influence (Salmerón et al. 2009, 1310), although the key lies not only in the links themselves: the non-highlighted text around the links affects user-perceived coherence (Karanam, van Oostendorp, and Indurkhya 2012, 21).

These research findings are again hardly applied to journalism. Zumbach and Mohraz (2008, 886) did not observe any notable differences in the use of the scroll or links when reading the news. Moreover, Stahl et al. (2007, 319) and Yaros (2006, 303) found out that the use of the opening paragraph and the creation of two versions of

varying complexity in journalism reduced cognitive load. But now that the Web has become a common environment for journalists and readers, the influence of factors such as the use of hyperlinks in news stories on how information is assimilated is still to be determined. As Skye Doherty points out:

> While journalism scholars have tended to focus on how hyperlinks are used, the approach in other disciplines to build authoring systems, develop research artefacts and optimise navigation, has enabled them to tackle issues such as comprehension in unbounded, virtual space. There is potential for journalism researchers and practitioners to draw on these ideas and produce new knowledge that is specific to their domain. (Doherty 2014, 133)

But above all, there is a major gap in the study of two of the key factors in the use of hypertext: quantity and size. First, the works that focused on the size of hyperlinks deepen into aspects such as the recommended number of links that should be included in each piece. Most of them point out that a balance between absence and excess must be achieved and that there is a need to satisfy any demand that reading can generate. It should be borne in mind that a link is providing additional material, not just breaking up the text (Price and Price 2002, 145–148). Landow (2006, 200), for example, concluded that a node that occupies two screens should have a minimum of three links. And for complex contents, users' demands will need to be anticipated through selection, editing and hierarchy: "Choose the best and eliminate the rest" (McAdams and Berger 2001). However, they are rarely based on quantifiable findings.

The second factor is even less explored. However, studies on the size of links present interesting results as they come from experimental designs. A study by Kalbach (2007, 141) revealed that longer links tended to be more efficient than shorter ones so long as they were not too long (between 7 and 12 words). According to Carroll (2010, 77), however, the capacity to scan a screen vanishes if links contain more than two or three words, which is the maximum a reader can process in just one glance.

Method

This study analyses the influence of two independent variables—the quantity and size of links—on three dependent variables: behaviour, perception and comprehension. The responses of a sample of 170 university students to six prototypic models of online news were analysed.

The method consisted of experimentation, the generation of certain actions within the group of subjects to subsequently study their effects and a comparison of the causal relationships between variables (Campbell, Stanley, and Kitaigorodzki 1963). More specifically, several versions of the same message were designed.

For the two variables, three alternatives were created:

(1) Quantity
    Model 1: Null—no link and only one node (or piece of information).
    Model 2: Moderate—5 links and 4 nodes.
    Model 3: High—24 links and 7 nodes.

FIGURE 1
Screenshots of two samples of the two kinds of model

(2) Size
  Model 4: Short—between 1 and 4 words.
  Model 5: Medium—between 5 and 12 words.
  Model 6: Long—between 13 and 32 words.

These models, shown in Figure 1, were created from articles published by print, television and online media outlets that included exactly the same information for each variable, though presented differently. A clear and simple interface was designed with large letters, a white background and a single navigation menu, and with an appearance similar to a news article (a headline, a picture, a signature and around 1000 words). The first three dealt with political news about a legislative change in local elections. The last three focused on international news on the latest military crisis in Ukraine.

To keep the possible interfering variables stable—such as the effect of the environment and reading order—and to obtain more reliable results, in addition to controlling the time (30 minutes) and the space, the aims of the study were not revealed to the participants. Subjects received an email in which they were informed that they were to form part of an investigation whose aim was to study "the response of the user to internet contents". They were asked to fulfil two conditions: to read, in eight minutes, all the content they possibly could of their assigned model and then to complete a questionnaire without consulting the contents again. The email contained a link to one of the six models and a link to the corresponding questionnaire.

One of the main shortcomings in the method design was the selection of the sample, which is one of the requirements for experimental validation. Due to limitations

in time and materials, we were unable to select a section of the student population that could be extrapolated and, as such, we opted for a sample of convenience. Golovchinsky, Chignell, and Charoenkitkarn (1997, 154) termed the results of these alternatives "meta experiments". In their opinion, experimentation should not be considered an "all or nothing" method; exploratory strategies can be used without loss of their advantages. Along this line, Campbell, Stanley, and Kitaigorodzki (1963) recognised that, in various situations, the researcher may introduce something similar to the experimental design into the data-gathering phase despite not having complete control of the experimental stimuli.

In Web design, similar experiments are referred to as user studies, which are usability tests based on the observation and analysis of the problems faced by a group of users during a series of tasks. According to Nielsen (2000), detecting all the errors in a website requires approximately 15 users, although most can be detected with just 5.

In this case, the sample was selected from a group of Journalism students enrolled at the Miguel Hernández University. An initial 225 subjects were asked to collaborate, of whom 170 participated (75.6 per cent). The number of completed questionnaires ranges from 24 (14.15 per cent) for Models 1 and 6 and 31 (18.24 per cent) for Models 2 and 5. The number of women (57.06 per cent) was greater than the number of men (42.94 per cent), figures which are close to those seen in the population of Journalism students: 306 women (59.65 per cent) and 207 men (40.35 per cent).

The main statistical indicators of the subjects' ages confirm that the typical user in this study was around 20 years old. The six groups were structurally very similar, since they were created randomly by dividing a homogeneous sample. Thus, although this division is unable to overcome the constraints of a non-representative sample of the population, it does allow groups in which comparisons are consistent to be created.

The experiment took into consideration certain key aspects of the user test: the experiment itself centred on variables with statistical metrics (Tullis and Albert 2013, 23), the questions focused on direct and immediate experience (Kuniavsky 2003, 121), the questionnaire was completed after navigation (Barnum 2011, 257), more than one design was compared (Tullis and Albert 2013, 55) and scenarios were created to situate the user (Kuniavsky 2003, 149).

The first pilot study was similarly based on another technique typical in Web design: heuristic evaluation. It was conducted with the collaboration of four assistant researchers, who knew all the experimental codes, in order to receive comments and suggestions. The second pilot study was carried out with a group of six students, who were treated as real subjects.

As for any quasi-experiment, precaution must be taken in interpreting the results. The numbers gathered in this study cannot be strictly extrapolated to internet users as a whole. Rather, these results attempt to confirm the "non-invalidation" of a set of hypotheses on the effect of links on news reception.

To analyse the dependent variables, various considerations were taken into account:

(1) The study of user behaviour, which is the subject of great interest for its objective and practical nature, is based on data extracted through Web analytics, a standard procedure in commercial research to analyse clicks (Ghosh, Jain, and Dekhil 2010, 283) but which was also conceived as a generic technique to investigate the "hidden rationality" of behaviours (Brown et al. 2004, 94) and which helps in the design of digital content in complex settings (Barthel, Ainsworth, and Sharples 2010, 224). Specifically, the following metrics were used: (a) "visit" or "session": the period of time the user spends looking at pages or Web applications on a server or domain; (b) "unique visitor" or "unique user": each person with a unique IP address who accesses a page; (c) "pages viewed": the number of times a particular page is opened; (d) "unique pages viewed": each of the pages a user views in one visit; (e) "average visit time": the average time a user stays on a particular website; (f) "average page time": the time a visitor spends on a particular page; (g) "bounce rate": percentage of visitors who have entered a website and then left it without visiting any additional page; and (h) "exit rate": the number of abandonments from a specific page of a website. This metric differs from the bounce rate in that visitors have interacted with more than one page.

(2) The study of the perception of hypertext content consists of quantifying users' assessments of six subjective variables: ease of reading, ease of navigation, and content clarity, interest and credibility. A six-point Likert scale online questionnaire was sent out after the general announcement: "Evaluate the level of compliance of this information to the following qualities". To facilitate understanding and interpretation of the data, the scores obtained were converted into a number out of 10.

(3) Comprehension was re-evaluated through surveys using an indirect mechanism in which questions were asked about the content followed by a comparison of the number of correct answers. In each survey, three questions about a news article were asked: what, who and why. In each case, specific questions were formulated regarding the content of a text of certain difficulty to avoid the influence of subjects' prior knowledge of the subject.

Results

Behaviour

Quantity. The data obtained reveals that the use of a greater number of links increases the average number of pages viewed and reduces abandonment rates. The third model, which contains 24 links and seven nodes, obtains better results in most of the audience figures than models that have a lower hypertextuality. The presence of a greater amount of hypertext also favours navigation between different pages.

TABLE 1
Web analytics data of user navigation as a function of the number of links

		Model 1	Model 2	Model 3
Visits	Pages per session	1.47	2.31	2.81
	Unique pages per user	1.26	1.54	1.94
Abandonment (%)	Bounce rate	68.75	64.10	64.86
	Exit rate	68.09	43.33	35.58
Time (minutes:seconds)	Average time	2:30	3:22	2:11
	Time spent on page	5:21	2:35	1:12
Page analytics (opening page) (%)	Opening page	–	50.00	29.00
	Link 1	–	46.00	39.00
	Link 2	–	4.00	21.00
	Link 3	–	–	7.00
	Link 4	–	–	4.00
	Link 5	–	–	0.00

The number of pages viewed per session and the number of unique pages viewed per user increases as the number of pages over which the content is distributed increases. As is observed in Table 1, the pages viewed per session for the model with no links (1.47) increases considerably for the prototype with a moderate number of links (2.31) and nearly doubles in the case of the model with a high number of links (2.81). This trend is also seen for unique pages viewed, with the prototype with lots of links (1.94) being greater than the model with some links (1.54) and the linear proto-type (1.26), although to a lesser extent. Thus, the intensive use of hypertext would increase the traffic in digital media and, therefore, could also improve their cost-effectiveness.

The results also indicate that greater fragmentation reduces the rates of abandonment, but in this case with an important nuance. The number of exits from the opening page decreases from the model with no links (68.09 per cent), the model with the least hypertext, to the prototype with a moderate number of links (43.33 per cent) and the model with a high number of links (35.58 per cent). The bounce rate, in contrast, though higher for the linear prototype (68.75 per cent), barely varies between the model with some links (64.10 per cent) and the prototype with lots of links (64.86 per cent), which may demonstrate that, above a certain number of links, the number of users staying on a page remains the same or even decreases.

This experiment also shows important differences in the average visit time. In this case, the prototype with a moderate level of hypertext gets the best results. The average time each user spends on the opening page decreases as fragmentation increases and, consequently, the number of words on it decreases. The time spent on a particular page in the model with no links (5:21) is twice that for the prototype with a moderate number of links (2:35) and five times that for the model with a high number of links (1:12). However, what is more notable is the overall amount of time a visitor spends on each model website as a whole. Here, the time spent on the model with some links (3:22) is greater than for the linear prototype (2:30) and the model with a high number of links (2:11), which would indicate that an average number of links benefits consumption time.

TABLE 2
Web analytics data of user navigation as a function of link size

		Model 4	Model 5	Model 6
Visits	Pages per session	2.21	1.78	2.04
	Unique pages per user	1.75	1.62	1.54
Abandonment (%)	Bounce rate	63.64	69.44	81.48
	Exit rate	45.21	56.25	49.09
Time (minutes:seconds)	Average time	1:55	1:33	1:24
	Time spent on page	1:35	2:00	1:21
Page analytics (opening page) (%)	Opening page	29.00	19.00	13.00
	Link 1	42.50	50.00	47.00
	Link 2	19.00	31.00	13.00
	Link 3	9.50	0.00	20.00
	Link 4	0.00	0.00	6.70
	Link 5	–	–	–

The page analytics information reveals that, for the model with some links, nearly all the actions carried out by the user are divided between the link that redirects them to the opening page (50 per cent) and the first that appears in the text or in the margin on the left-hand side (46 per cent). The fewer number of clicks made on the second link (4 per cent) indicates the importance of order when there are fewer links. The presence of more hypertext, therefore, implies a relative increase in the distribution of navigation.

Size. The experiment reveals that short links favour the metrics related to visits and abandonment rates. The audience figures are better for Model 4, which contains links composed by one to four words. Links with a greater number of words yield negative results for the time the user spends reading. Therefore, if online media would like to increase their number of unique visitors and the average visit time, they should shorten their links.

Short and intermediate-sized links work better when users want to navigate in more pages, as shown in Table 2. The number of pages viewed per session for the model with short links (2.21) and the model with long links (2.04), the models with the shortest and longest links, respectively, is greater than for the prototype with medium-sized links (1.78), which is theoretically the most balanced. In contrast, when unique pages viewed are taken into account, the prototype with large links (1.54), the model with the longest links, yields figures lower than the others.

When analysing the chances that the user would abandon the Web page, shortness of the links is a positive factor. The bounce rate for the prototype with brief links (63.64 per cent) is lower than that for the prototype with medium-sized links (69.44 per cent) and, in particular, the model with long links (81.48 per cent). The prototype with brief links (45.21 per cent) also registers a lower exit rate than the other models.

The size of the links has less influence on the time spent by a user per session. The average time for the whole model is slightly greater for the model with short links (1: 55) than for the prototype with medium-sized links (1:33) and the

model with long links (1:24). In contrast, the model with average links (2:00) registers higher figures than for the prototype with brief links (1:35) and the prototype with large links (1:21) for the time the user spends on the opening page. Very long links yield negative figures for navigation, while medium and small links present similar values.

The visibility of the other links, however, tends to increase when its size increases. The number of clicks on the first link is similar for the three models, but for the model with long links, the third link appears to be important, registering 20 per cent of the clicks, which is greater than for the other models and even the link immediately before it (13 per cent of clicks), which is unusual.

Perception

Quantity. The perception of the users interviewed increases as the amount of hypertext in the news item increases. Table 3 shows that model 3, the most hypertextual one, obtains better results in the subjective assessment of the user, especially in regard to readability, clarity and interest.

Content fragmentation increases the perception of the ease of reading. The model with a high number of links registers a higher score (7.72) than the prototype with a moderate number of links (6.51) and, especially, the model with no links (5.97). By contrast, users consider navigation to be most comfortable in the model with a moderate number of links (8.33).

In terms of clarity, the model with the greatest amount of hypertext once again obtains the highest score (7.28). By contrast, the prototype that has an intermediate number of links receives a lower score (6.45) than the linear prototype (6.74), which has no links at all. Thus, in terms of clarity, a greater amount of hypertext is clearly favoured above an intermediate quantity.

This trend is also seen in the perceived content interest. Although the overall figures are lower, the model with the greatest number of links receives a higher score (6.89) than either the model with no links or the model with a few links. Moreover, once again, the model with an intermediate amount of hypertext scores less (6.45) than the one that has no links (6.74).

The analysis of credibility yields the most surprising result: the model with no links generates greater credibility among the users interviewed, with 7.99. This result is

TABLE 3
Results of perception variables as a function of number of links

	Model 1	Model 2	Model 3
Ease	5.97	6.51	7.72
Comfort	7.64	8.33	7.78
Clarity	6.74	6.45	7.28
Interest	6.60	6.40	6.89
Credibility	7.99	7.37	7.17
Average	6.99	7.01	7.37

TABLE 4
Results of perception variables as a function of link size

	Model 4	Model 5	Model 6
Ease	7	6.99	6.6
Comfort	7.47	8.22	7.39
Clarity	7.01	7.11	6.3
Interest	7.67	7.37	7.36
Credibility	7.39	7.26	7.5
Average	7.31	7.39	7.03

difficult to explain. Perhaps information is trusted more when all the data are presented in one page.

The model with the greatest number of pages and links obtains the highest score for all the variables studied, with 7.37. The extensive use of hypertext and the resulting fragmentation of information has, therefore, become an accepted and valued feature for users.

The most surprising result is the fact that the prototype that contains no links (6.99) obtains a score almost equal to that of the one that has a limited amount of hypertext (7.01). It can be concluded that the scroll is still a useful tool in the presentation of online news and that a limited use of hypertext may not be very decisive.

Size. In terms of perception, the model with intermediate-sized links registers the highest score because it gets better scores in clarity and convenience. Not far behind, however, follows the model with the shortest links, which users found easiest to read, which is positioned clearly above the one that has the longest links.

Table 4 shows that, in terms of the ease of reading, the two models with smaller-sized links, which have nearly identical results (7 and 6.99), register higher scores than the prototype that has the longest links (6.6). The model with long links also registers the lowest scores in terms of comfort, with 7.39.

A similar trend is seen in the scores for perceived content clarity. The score for the model that has medium-sized links (7.11) is higher than the model with the longest links (6.3) and only marginally higher than the one that has the shortest links (7.01). In terms of interest of content, the trend reverses and the model with the shortest links now receives the best evaluation (7.67).

The analysis of credibility once again yields contradictory results: the model with the longest links receives the highest score, 7.5, while this same model receives the lowest scores in the other variables.

These results confirm that the model with links between 5 and 12 words long is the most popular among users, receiving an overall score of 7.39. This is explained by its higher scores for comfort (8.22) and clarity (7.11). However, not far behind is the prototype with brief links, with a score of 7.31, which is a result of its score for interest of information (7.67). Also it is quite clear that links of between 13 and 32 words are of little use, since they only exceed the others in their score of credibility (7.50).

Comprehension

Degree. In contrast to the results obtained for behaviour and perception, the model consisting of only one page, the first one, receives a positive evaluation in the comprehension analysis. This result indicates that, although text with no links obtains worse results in terms of Web analytics metrics, users recall information from link-free texts more easily.

TABLE 5
Results for text comprehension as a function of number of links (%)

	Model 1	Model 2	Model 3
Correct	37.50	20.43	22.22
Incorrect	62.50	79.57	77.78

The linear prototype (37.50 per cent) amply exceeds the prototype with lots of links and the model with some links, both of which yield similar results in terms of the percentage of correct replies regarding the content, with 22.22 and 20.43, per cent respectively. The medium term, again, displays more negative results than the other options, as is seen in Table 5.

Size. The models that use the shortest links are also the easiest to understand, although those with longer links obtain scores that are only marginally lower. Brevity of links seems to be a solid trend for increasing readability.

TABLE 6
Results for perception variables as a function of link size (%)

	Model 4	Model 5	Model 6
Correct	61.11	52.69	58.33
Incorrect	38.89	47.31	41.67

The model with short links (61.11 per cent) lies just ahead both of the prototype with large links (58.33 per cent) and the model with average links (52.69 per cent). Therefore, Table 6 proves that users understand texts with short or long links. However, texts with medium-sized links perform worse.

Discussion

These results confirm the main hypothesis (H1), which postulates that the amount of hypertext and the size of links affect readers' behaviour, perception and comprehension of online news.

In contrast, the results contradict the initial predictions of the more specific hypotheses, which preview better results in a more balanced use of quantity and size

of links. H1a is not satisfied for any of the three characteristics studied here. User behaviour and perception scores are greater when contents include a greater amount of hypertext. In contrast, comprehension obtains better results when the contents are presented on a single page with no links. H1b is only satisfied for one of the three characteristics: in the analysis of perception, medium-sized links produce positive results. However, user behaviour and comprehension scores improve when shorter links are used.

The model with most links obtains the highest scores for most of the metrics analysed: pages viewed, abandonment rate and time metrics. These results reveal an important feature of online news consumption, especially for the effect these three metrics have on users and, therefore, their social and advertising relevance. A similar pattern is seen in the analysis of user perception, in which the model with the greatest amount of hypertext obtains higher scores than the others in terms of readability, clarity and interest of content. In contrast, comprehension yields better results when contents are presented on only one page with no links, indicating that some users still assimilate plain text better.

This experiment, therefore, proves that contents with a greater number of links or with shorter links obtain better scores for perception, comprehension and, in particular, behaviour. Hypertext, therefore, represents a phenomenon that is assimilated and valued by users, at least, among younger and better-informed users.

Most of these findings agree with the previous literature; however, there are some nuances and differences that need to be clarified. As most studies suggest, it seems that links are one of the keys to better navigation. These elements play an important role in the attention that users pay to news content. In a journalistic context, links help users meet everyday needs, ranging from the trivial to the profound, and allow them to optimise the time they spend on consuming news (Beam and Kosicki 2014, 71–72). Thus, link usage has transformed the patterns on news consumption, where new journalistic elements are required, so the media can no longer remain ignorant of the changes in users' behaviour.

Links also have an effect on users' perception, the attention they pay to news and, therefore, the ability of news to influence them (McEneaney et al. 2009, 36–37; Shen, Ahern, and Baker 2014, 108–109). Also this influence favours other aspects such as curiosity (Lee, Heeter, and LaRose 2005, 21) and credibility (Das and Pavlíčková 2013, 393), especially in a journalistic context (Borah 2014, 586–588; Chung, Nam, and Stefanone 2012, 182).

Most of the contradictions, however, are found in the area of users' comprehension, associated with one of the essential functions of journalism: keeping the public informed. Our findings also reinforce early research about hypertext, which concluded that linear texts were understood better than multilinear ones. There are also other key factors, such as the influence of news design and of the non-highlighted text around the links, on user-perceived coherence (Karanam, van Oostendorp, and Indurkhya 2012, 21).

These results do not confirm the findings of Zumbach and Mohraz (2008, 886) in the field of journalism, who did not observe any notable differences in the use of the scroll or links when reading the news. Our results are not supported either by Kalbach's (2007, 141) study that revealed that longer links tended to be more efficient than shorter ones, so long as they were not too long (between 7 and 12 words). However,

they support Carroll's (2010, 77) findings, which show that the capacity to scan a screen vanishes if links contain more than two or three words, which is the maximum a reader can process in just one glance. Above all, these results indicate that there is a major gap in the study of two of the key factors in the use of hypertext, quantity and size, with the need for further studies.

Conclusion

This study has several implications for the professional practice of journalism. Journalists should use the greatest number of links possible, so long as they are relevant and suitable, as the academic literature proposes. The ability to increase information, to produce greater narrative possibilities and to endorse the validity of contents improves the public service inherent in journalism. Users not only efficiently consume these types of content, they also value them positively.

The scores for user behaviour also improve when links are shorter, although to a lesser degree. This is also observed for comprehension, although the difference between the figures is less marked. In the analysis of perception, however, medium-sized links obtain better results, although these are only marginally better than those for shorter links, especially in terms of comfort and clarity of reading. It is recommendable, therefore, that digital journalists use the least possible number of words when creating links. In this way, navigation and content assimilation would improve.

As we have noted, this research has certain methodological limitations. For example, the sample consists of a specific selection of participants that does not allow the results to be extrapolated to the rest of the population. Rather, it aims to serve as an exploratory study. The creation of six almost structurally identical groups allows consistent comparisons to be made, but a representative sample would require a much more complete selection of the whole population.

For the analysis of behaviour, the use of techniques such as eye tracking had to be ruled out since, although they enhance user analysis, they are costly and are not considered necessary to obtain valuable data. A further limitation of the study is the measuring of comprehension for Model 1, which consists of just one page. The results obtained in this case need to be taken with caution due to possible contaminating answers from those users who were unable to comply with the experimental instructions. In addition to the links of the models and the questionnaires, the participants were asked not to re-consult the information once they had started to answer the questions. Whilst we insisted that rule was obeyed, it proved impossible to control for this during the whole process.

Our results show, in line with recent research, the importance of hypertextuality in the changes on content reception. Links often might seem invisible and they might be assimilated in other narratives. As Doherty (2014, 124) has pointed out, hypertext is under-researched in journalism practice, especially in fields such as comprehension and readers' involvement. Our study highlights that links influence behaviour, perception and understanding, and that news users are increasingly demanding a more abundant and subtle hypertextuality.

As it was foreseen, hypertextuality has become a daily practice, assimilated and valued by users. But, contrary to what was taken for granted, it seems evident that the

use of hyperlinks should not be mitigated nor should medium-sized anchors be created in order to improve the reception of news content.

In summary, this exploratory study provides important conclusions in the advancement of knowledge of user responses during the consumption of online news. It is a starting point in a field in which in-depth long-term studies with more representative samples should be carried out that have a bearing on the objective and subjective consequences of users' behaviour when reading hypertext.

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