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[Barbara S. Chaparro](#), Editor

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## Where Should You Put the Links? A Comparison of Four Locations

by [Michael Bernard](#), Spring Hull, & Denise Drake

Online newspapers and journals, as well as many other types of informational sites, are invariably confronted with the question of where to place links associated with the online document. Currently, many informational sites place associative links below (as seen with [CNN.com](#)) or on the side of the document (as seen with [techreview.com](#)), while a shrinking number of sites embed associative links within their documents, such as [scientificamerican.com](#).

Placing associative links either outside or within a document has both benefits and drawbacks. The placement of links outside of a document (explicit links) may promote quicker selection times once the context of the link is known, since the reader does not have to wade through the entire document to find the link. Moreover, readers exposed to explicit links may be less prone to digress to other information paths before completely reading and grasping the meaning of the entire document. If digression does occur, then information may be retrieved faster with explicit links. On the other hand, embedding the links may provide an important context that would be absent if they stood outside of a document. It also may provide for a stronger association between the main document and the secondary, associative pages.

Unfortunately, there has been very little empirically validated research concerning associative link placement within online documents, and none dealing with web-based systems. One of the only published studies on associative link placement found that more questions were answered correctly and fewer extra nodes were visited using embedded menus than with explicit menus. Participants also preferred the embedded menus to the explicit ones (Koved & Shneiderman, 1986).

However, the studies reported by Koved and Shneiderman (1986) used a dos-based, keystroke menu system in which the links were taken from an pre-existing database. Moreover, in their study, as well as other studies pertaining to this topic (i.e., Powell, 1985), the explicit links were not accompanied with an associative passage as would be found with a typical web-based document. Consequently, it is difficult to generalize these studies to typical web-based informational documents. With this in mind, we sought to compare an embedded link arrangement with three explicit link arrangements in order to determine their actual and perceived search performance differences.

### METHODS

A Pentium II based PC computer, with a 60 Hz, 96dpi 17" monitor with a resolution setting of 1024 x 768 pixels was used. The participants' performance was tracked by using Ergobrowser<sup>TM</sup> software.

In one condition the links were embedded within a document, as would be found with many online documents (see Figure 1). This was accomplished by using an original online article with embedded links. A second condition placed explicit links at the bottom of the document (see Figure 2). Another condition placed explicit links at the top-left of the document (see Figure 3), and a fourth condition placed the explicit links at the same height to which it corresponded with the associative article (see

Figure 4). All of the passages came from Scientific American online articles.

<p style="text-align: center;"><b>Who Were the First Americans?</b> If your answer was fire-chad mammoth hunters, guess again</p> <p>The leaf-shaped spearpoint I'm holding is surprisingly sturdy—for a deadly weapon. I set my mind to work, trying to imagine life some 14,700 years ago in the mountains of southern Chile, where the relic was found. The 30 or so people who lived there then, at the cradlelike campsite now known as <a href="#">Monte Verde</a>, were some of the earliest inhabitants of South America—most likely descendants of people who reached North America by crossing the <a href="#">Bering land bridge</a> from Asia at least 15,000 years ago, perhaps more. Did this coming crew realize they were such pioneers? Or are such matters reserved for people who don't have to worry about where to find their next meal?</p> <p>My thoughts are interrupted by <a href="#">Tara Dillehay</a>, professor of anthropology at the University of Kentucky and the man who in the 1970s uncovered Monte Verde, the oldest known site of human habitation in the Americas. In a basement classroom on the university's campus, Dillehay has opened out a gallery of artifacts from Monte Verde on the table before me. He directs my attention to a fragment of another spearpoint, which, were it still intact, would be virtually identical to the one I'm holding. "These were probably made by the same person," he says.</p> <p>The early images of primitive explosive weapons, and I suddenly picture a single artisan spending hours, perhaps days, crafting these stone tools, each less than four inches long and half an inch wide. The workmanship is exquisite, even to my untrained eye: the series of tiny notches that form the sharp edges are flawlessly symmetrical. Whoever made these tools was clearly a perfectionist.</p> <p>The question of when people first reached the Americas has been an ongoing discussion in anthropology and archaeology circles for years. Yet how the first Americans actually lived—how my diligent toolmaker spent his (or her!) days—is only now receiving significant attention. The findings at Monte Verde shattered the previously accepted view of early life in the Americas, which had been considered to be around 14,000 years ago. (Because of the significance of this shift in thinking, acceptance of the Monte Verde site was a slow process; the archaeological community did not endorse Dillehay's analysis until 1997, when a paper on the site was published in the journal <a href="#">Science</a>. A handful of scholars still have reservations about the age of the site.)</p> <p>Excavations under way in the eastern U.S. and throughout South America hint that humans' arrival date may have to be pushed back to as far as 20,000 or even 40,000 years ago. Such discoveries may very well do more than just alter our understanding of how long people have lived in the Americas. With every new artifact, researchers like Dillehay are slowly piecing together more about the day-to-day lives of the early Americans: how they hunted, what plants they ate, how they moved across vast stretches of land.</p> <p>The canonical view of how humans first reached the Americas can be traced back to 1589, when <a href="#">Johannes de Acosta</a>, a Jesuit missionary to South America, suggested that the original Americans had somehow migrated from Siberia many thousands of years ago. The theory persisted, and by the early part of the 20th century archaeologists had agreed on the identity of the very first Americans. The evidence seemed irrefutable: Archaeological sites dating to approximately 13,000 years ago had turned up all across the landscape, nothing older had yet been found. Moreover, the tools from these sites shared striking similarities, as though the people who created them had a common cultural background and had all moved onto the continent together. Researchers termed these people and their culture "Clovis" (after Clovis, N.M., where the first such artifact was found).</p>	<p style="text-align: center;"><b>Who Were the First Americans?</b> If your answer was fire-chad mammoth hunters, guess again</p> <p>The leaf-shaped spearpoint I'm holding is surprisingly sturdy—for a deadly weapon. I set my mind to work, trying to imagine life some 14,700 years ago in the mountains of southern Chile, where the relic was found. 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<p style="text-align: center;"><b>Figure 1. Links embedded in document</b></p>	<p style="text-align: center;"><b>Figure 2. Links at bottom</b></p>
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<p style="text-align: center;"><b>Figure 3. Links at top-left</b></p>	<p style="text-align: center;"><b>Figure 4. Links corresponding with document</b></p>

Figure 3. Links at top-left

Figure 4. Links corresponding with document

## Participants

Twenty participants volunteered for this study. They ranged in age from 18 to 49, with a mean age of 26.6 (S.D. = 9.6 years) and with an average of 3.3 years in college. The median computer use for the participants is 7-14 hours per week. None of the participants previously visited Scientific American ([www.scientificamerican.com](http://www.scientificamerican.com)).

## Procedure

Participants presented within four documents, each with a different link arrangement. For each arrangement they were instructed to search for specific information pertaining to ten questions related to that document (such as, "*Who found evidence linking tribes from Siberia to the Americas?*"). Each question had to be properly answered within five minutes to be considered correct. Approximately 40 percent of the questions pertained to information located on the initial page, while the other 60 percent was located within a passage at a second level. This forced them to read and integrate the content at both levels. Participants could search until they found the correct information by using the Back button, or until the time expired. The link arrangements, passages, and their associated questions were counterbalanced by means of a Latin square design.

After finishing all the questions for each condition, participants answered a questionnaire. The questionnaire consisted of a 6-point Likert scale, with 1 = "Disagree" and 6 = "Agree" as anchors. The questionnaire items are presented below. After participants answered the respective questionnaires for each condition they ranked the four link arrangements for general preference.

## RESULTS AND DISCUSSION

A within-subject ANOVA design was used to investigate actual performance (mean task completion time and search efficiency) and perceived performance for four types of link conditions. Post hoc comparisons were done by using the Bonferroni test. The preference for each condition was measured by means of a Friedman  $\chi^2$ .

### *Accuracy*

No differences in the accuracy in finding information was found between the four link arrangements. That is, all participants were able to find the correct task information.

### *Task Completion Time*

Assessing the time needed to complete the search tasks for each link arrangement found no significance differences among them (see Table 1 for means and standard deviations).

### *Search Efficiency*

Search efficiency was determined by accessing the number of 'clicks' on the scroll bar, and the use of the Back button in order to find the correct task information. It is asserted here that a high number of clicks and use of the Back button indicates a high amount to searching and, thus, an inefficient link arrangement.

In examining the mean number of scrolling clicks taken for each task, no significant differences were found between the four link arrangements. This was also true in the use of the Back button. (see Table 1 for means and standard deviations).

**Table 1. Task Completion Time and Efficiency Means (S.D.)**

	Embedded	Top-left	Corresponding	Bottom
Task Completion Time (sec)	123 (50)	126 (42)	126 (49)	125 (41)

Scrolling 'Clicks'	16.2 (6.7)	16.4 (8.1)	15.4 (5.6)	15.0 (8.4)
Use of 'Back' Button	14.1 (8.0)	16.4 (11.4)	12.7 (6.0)	12.1 (6.7)

*Ease of Navigation*

Examining perceptions of ease of navigation revealed a marginal main effect [ $F(3, 57) = 2.58, p < .063$ ], suggesting that the Embedded arrangement was generally perceived as being easier to navigate than the other link arrangements (see Table 2 below for means and standard deviations).

*Ability to Recognize Key Information*

Examining the perception that a specific link arrangement promoted the ability to recognize key information found significant differences [ $F(3, 57) = 2.99, p < .038$ ] in that participants perceived the Embedded arrangement as allowing them to recognize key information more than the other arrangements (see Table 2 below for means and standard deviations).

*Link Arrangement Promotes Comprehension*

Examining the perceptions that a specific link arrangement promoted comprehension revealed significant differences [ $F(3, 57) = 7.46, p < .001$ ] in that the Bottom link condition had significantly lower levels of this perception than either the Embedded or the Corresponding conditions (see Table 2 below for means and standard deviations).

*Ability to Follow the Main Idea of Passage*

Examining the perceptions that a specific link arrangement promoted understanding of the passages' main idea revealed significant differences [ $F(3, 57) = 3.90, p < .013$ ] in that the Bottom link and Top-left conditions had significantly lower levels of this perception than the Embedded condition (see Table 2 below for means and standard deviations).

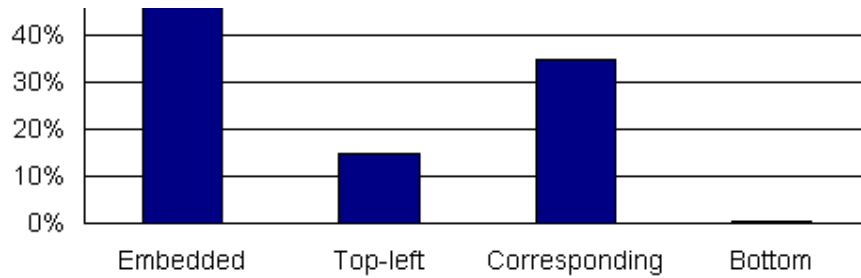
**Table 2. Impressions of Link Locations - Mean(S.D.)**

	Embedded	Top-left	Corresponding	Bottom
Task Completion Time (sec) Easy to navigate	4.35 (1.14)	4.15 (0.81)	4.20 (1.20)	3.45 (1.50)
Able to recognize key information	3.80 (1.15)	3.40 (0.99)	3.45 (1.28)	2.75 (1.21)
Link arrangement promotes comprehension	4.30 (1.03)	3.35 (1.23)	3.65 (1.50)	2.45 (1.28)
Easy to follow the main idea of the passages	4.35 (1.81)	3.45 (0.76)	3.55 (1.50)	3.30 (1.71)

*Link Arrangement Preference*

Analysis of the participants' preference for each link arrangement revealed a significant difference in ranking [ $\chi^2(3, N = 20) = 22.5, p < .001$ ]. Further analysis revealed that the Embedded link arrangement was significantly preferred over the Bottom arrangement. Overall, 50% of the participants chose the Embedded links as their first choice. None of the participants chose the Bottom arrangement as their first choice (see Figure 1).





**Figure 5. Percentage chosen as first preference choice.**

## CONCLUSIONS

Several observations can be made from this study. First, no significant differences between the four link arrangements were detected in terms of search accuracy, time, or efficiency. This suggests that the link arrangement for documents within a single frame does not have a great affect on its actual navigability.

However, there were significant subjective differences between the link arrangements favoring the embedded links. That is, participants indicated that they believed that embedding the links within a document made it easier to navigate, easier to recognize key information, easier to follow the main idea of the passages, and promoted comprehension. Moreover, participants significantly preferred the Embedded link arrangement to the other arrangements. Conversely, placing links at the bottom of a document was perceived as being the least navigable arrangement, and was consequently least preferred.

Although no significant objective differences were found, the consistent results of the subjective perceptions of link navigability, as well as general preference, suggest that the Embedded link arrangement is perceived as being the superior format for online documents within a single frame. For this reason, it is suggested that for documents using a format similar to the type tested in this study, embedded links should be considered.

## REFERENCES

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- Powell, D. (1985). *Experimental evaluation of two menu designs for information retrieval*. Unpublished research. In Norman, K. (1991). *The Psychology of Menu Selection*. Norwood, NJ: Ablex Publishing Co.

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