ASPECTS OF LINKOLOGY
A Method for the Description
of Links and Linking

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Introduction

This article proposes a theoretical framework for the description and analysis of links and linking in different kinds of works. The aim is to present the nomenclature for a "linkology,"[1] to provide a terminology facilitating discussions on links and linking. It is important to note that the discussion mainly deals with how different types of links and linking function structurally. Thus other interesting issues such as the implications of links in terms of aesthetic effects etc., are beyond the scope of this study.[2] It should be stressed also that these structural aspects are discussed and described primarily from a user perspective. I am acutely aware that something that from a user perspective seems to be a simple point-blank procedure, often is a much more complex and complicated process on a deeper, more technical level.[3]

Furthermore, it is worth noting that the study mainly belongs to the theoretical tradition of hypertext theory, by which I here refer to the theoretical discussion on literature and digital media initiated by Jay Bolter, Michael Joyce, George P. Landow and Myron Tuman in the early 1990's, and continued by scholars such as Espen Aarseth, Jane Yellowlees Douglas and Janet H. Murray. (Cf. Pang 1998) Finally it should be emphasized that due to rapid technological development, especially in the digital field, the examples are to be considered more or less historical. What I describe as a trait characteristic of an ordinary web page or a computer game may

be replaced by something else tomorrow. As a result, the theoretical framework presented is not to be thought of as fixed and complete, but as moldable and expandable.

Types of Links and Linking

A *link* is a pointer leading the user from one textual spot to another. Links are explicit connections between works and parts of works. To follow a link is to be guided from one place to another; from the sentence in the main text to a specific footnote, from one web page to another, from the first page of a newspaper to a certain page in the paper etc. Naturally, links can appear both in monosequential and multisequential texts. [4]

In the following, the text or the part of a text from which a link departs is referred to as a *link source* while the text or the part of a text to which a link leads is called a *link destination*. The exact spot in a link source or a link destination to which links are attached has been called an *anchor*. [5] In typographic texts, the anchor is usually a fairly small part of the source or the destination; often, the anchor is a word, a footnote number or perhaps a sentence. Link sources and destinations vary in size and scope; theoretically, they can consist of anything from a single alphanumeric sign to an entire work or even several works. It is important to remember also that link sources and destinations often are part of another, larger link source/destination and, at the same time, consist of smaller sources and destinations. In a novel, for example, a paragraph, a chapter as well as the entire work may serve as link destination and/or link source. [6]

Analog and Digital Links

The most vital difference between analog and digital links is that *analog links* (like typographic links) are processed by humans, while *digital links* are processed by machines (e.g. a computer). In other words, the analog links use instructions for their realization that are written for man, while digital links use instructions that are written for machines.

With many digital links, the user, by pressing a key or clicking on a word, etc., signals that she wants to follow a certain link. The link destination is then promptly activated and presented to the user. For technical

reasons this is not possible in print, and the user is therefore obliged to actively follow instructions provided (explicitly and conventionally) by the anchor in the link source. One could say that whereas digital link destinations always come to the user, typographic links mostly require the user to come to the link destination (by moving her gaze, turning pages, getting another book, etc.).[7]

Typographic links exist also in digital media, and text in digital media often has both digital and typographic links. In fact, in digital media, a typographic link may serve as an alternative to a digital link. For obvious reasons, though, the digital link generally predominates over the typographic link – why scroll when it is possible to click? However, the typographic links are excellent stand-ins when the digital links do not work, for some reason.

To function, both analog and digital links depend on the user having the knowledge of how to deal with these features. In order for the user to know what to do when running into a blue, underlined word on a web page or a superscript four in a dissertation, the knowledge of how to interpret and handle links must be an integral part of her navigational competence.[8] One could say that the user must have internalized a set of instructions informing her on how to recognize and use links. Of course, this set of instructions is not an absolute package but varies from user to user, who acquire them by experiencing different texts.[9]

Internal and External Links

Links have their source and destination within a single work or in different works. Links within a work are called *internal links* while links running between works are labeled *external links*.[10] Clearly, these types of links closely depend on the concept of work and the adopted perspective, that is, what is considered a work is crucial when characterizing links as external or internal.[11] From one point of view, a link may be described as external whereas from another point of view, it may be regarded as internal. Take for instance a link from one academic paper to another (in for example a footnote reference.) This is an external link from the writers' point of view. But if the two papers are collected in the same anthology, the link may be seen as internal (within the book) from the point of view of the reader. If a website is considered a work, internal links run within the website (within a page and between pages) while external links lead to other web pages.

Unidirectional and Bidirectional Linking and Links

Unidirectional linking and *bidirectional linking* have to do with the possibility, or lack of such, to go back to the place that one just came from, "to retrace one's steps". (Landow 1997, 11). Unidirectional linking is when there is no explicit back link in the link destination leading back to the link source. Links involved in unidirectional linking are labeled *unidirectional links*. Bibliographical references in footnotes indicating, for instance, a specific page in another work, are almost always examples of unidirectional links – there are rarely any links in the destination text leading back to the footnote in the first text.

Bidirectional linking is when an explicit back link leads from the destination of a link back to its source. On one level, it is sufficient to describe texts as bidirectionally linked, i.e. there is a two-way connection between the two linked texts. However, bidirectional linking may also be studied and described in more detail. Bidirectional linking involves two links, one forward link, so to speak, and one back link. At least two anchors are required in bidirectional linking, but three or even four anchors may be used. Consequently, the forward link and the back link may either use the same anchors or different anchors.[12] Here the term *homoancoral* is used to designate that a forward link and a back link have the same anchor, while *heteroancoral* indicates that they use different anchors.

In order to fully describe bidirectional linking between two texts, the anchor issue must be considered in both texts, that is on the one hand, the text in which the forward link has its source and the back link its destination, and on the other hand, the text in which the back link has its source and the forward link its destination. As a result, four types of bidirectional linking are possible:

Source \ Destination	homoancoral	heteroancoral
homoancoral	x	x
heteroancoral	x	x

Figure 1. Types of bidirectional linking.

From now on, the source and the destination are described in the syntax source/destination.

The term *bidirectional link* is here reserved for bidirectional linking that is homoancoral/homoancoral.[13] This is the case, for example, with an ordinary footnote in print where the forward link leads from the footnote number in the main text to the footnote number in the footnote, and the back link leads from the footnote number in the footnote to the footnote number in the main text.

Although both unidirectional and bidirectional linking may easily be found on the web, unidirectional linking seems to be more common. In most browsers, however, there is a return function that generally allows the user to jump back to the previously visited page or spot on a particular page. This creates the effect of bidirectional linking. However, it should be remembered that retracing one's steps by using the browser has nothing to do with links of works. (Cf. Vanhoutte 2000, 110–111). The browser keeps track of the visited URLs; when the return function is used the browser simply displays the previous page. These pages may be interlinked (like when surfing within a website), which reinforces the effect of bidirectional linking. But it may also be the case that the pages have nothing to do with each other, for example when the URLs were typed manually or selected from the URL list in the browser, or when the pages were retrieved through a search engine.[14] (Cf. Landow 1997, 11). Even though this allows the user to move smoothly between web pages, it is different from using links that are part of the work.

Unconditional and Conditional Links

Unconditional links can be followed under any circumstances at any time; the only thing needed is the accurate navigational competence. Most typographic links are unconditional for all practical purposes. Similarly, many digital links in web published texts are unconditional and can be followed by anyone at any time. In most cases, all links from a web page are unconditional. In contrast to an unconditional link, a *conditional link* can be followed only if certain conditions are fulfilled. (Aarseth 1997, 63–64). A suitable example from the everyday life is the password – we are not allowed to follow the link unless we know and can state the correct word. With conditions, the access to links can be controlled in detail.

A conditional link is non-ergodic when the user does not explicitly and deliberately choose one alternative or the other, like when a content space is only available after exactly thirty-five seconds.[15] Ergodic conditional links, on the other hand, require the user to make a non-trivial choice of which link to follow, for example by choosing between objects displayed on the screen. Of course, ergodic conditional links do not always order the user to choose between alternatives; the condition may also be that a certain task must be accomplished.[16] These kinds of conditional links have a key role in many computer games in which the player has to fulfill certain missions in order to get to the next level, the next room, or the next city, and, in the end, to succeed in saving the princess or killing the dragon.[17]

Intricate and complicated conditional linking may, for obvious reasons, be most successfully created in a computer. However, conditional links do exist in other media as well. The most frequent conditional links in analog media are perhaps those attached to anchors like 'to be continued…' and others where the condition consists in the passing of a period of time. This type of conditional link can be found in print media as well as on television, on the radio and, naturally also in digital media.

Visible, Invisible and Hidden Links

The existence of a link may be indicated or not. Links that can be identified simply by looking at the text are called *visible links*, while links that cannot be visually detected are labeled *invisible links*. Links that the user can make visible (by pressing a key or moving the cursor, etc.) are referred to as *hidden links*. In most cases, it is not the links as such that are

visible, invisible or hidden (they are in general all invisible) but their anchors. Anchors are often indicated in some way in order to stand out in the text, making it easier for the user to find the links. This anchor indication is called a *cue*. A standard cue for anchors on the web is the blue color in combination with underlining. (Kaplan 2000, 223–228; see also Kaplan & Moulthrop 1997, 2.2.4.) In print, the cue of footnote number anchors usually involves a smaller font and a superscript position.

Invisible links are practically impossible to achieve in print media since typographic links always contain more or less explicit instructions as to where to find the link destination. In other words, these kinds of links automatically have cues since they must provide instructions regarding the link destination. Digital links, on the other hand, may be invisible. Truly invisible links, however, seem to be rather unusual and the majority of links are more accurately referred to as hidden links since a certain keystroke or a mouse movement will make them visible.

Uncategorized and Categorized Links

Uncategorized links give no information whatsoever on the character of the link destination. The typical example is the underlined blue anchor in a web document – the user knows that the place is linked, but not to what kind of destination. In contrast, *categorized links* provide the user with more or less information on the link destination.[18] The information provided may, for instance, concern the textual and typographic character of the destination, the relation between the source and the destination or the content of the destination.[19] But differences between categorized links are not only related to what kind of information they give but also to how much information they give. In other words, categorized links have a variable degree of precision.[20]

As to categorized links, it is generally the anchor from which the link leads that carries the information; a traditional footnote number anchor like the one following this sentence is interpreted by means of a set of typographic conventions, which tells you that the link leads to a footnote, which is a comment of some kind, often printed in smaller font and placed at the bottom of the page or at the end of the chapter.[21] This anchor provides relatively little information, however, compared to bibliographical references in footnotes. Of course, bibliographical references also vary in complexity and precision concerning the link destination. In fact, typo-

graphic links are categorized by definition since they always, as I have explained, depend on instructions directing the user to the link destination. By indicating works, pages, lines, footnotes, chapters, etc., these instructions inevitably give more or less information on the link destinations.

On web pages, one method of creating categorized links is to make a comment describing the link destination appear in a small textual window when the cursor is placed over the anchor. Another method is the use of icons giving information on the destination. Links may also be categorized by means of different link cues and a certain color, for instance, may indicate a specific link type.

Ancoral Text

Link sources and link destinations may contain one or several anchors. The terms used here to designate the number of anchors are *uniancoral* and *multiancoral*, where the former indicates that there is only one anchor and the latter that there are several.[22] Although the majority of links do depart from one anchor within a link source, links sometimes lead from an entire link source. This might be the case with mainly spatial link sources, like a photo or a picture. Link sources of this kind, and destinations, for that matter, are described as *omniancoral* since the link uses an *omnianchor*.[23] An omnianchor may coexist with other anchors. If that is the case, the source (or destination) cannot be characterized as omniancoral, but must be described as multiancoral.[24] What is more, the term omniancoral must not be confounded with the term nonancoral designating the complete absence of anchors and, consequently, of links. In other words, a *nonancoral text* is a text without links. For obvious reasons, nonancoral texts are not particularly interesting in the present discussion on *ancoral text*.

Only mainly spatial link sources and link destinations may have omnianchors. This is because mainly temporal sources and destinations always have a beginning and an end, which serve as anchors. Anchors of this type are somewhat similar to default anchors (cf. below), and they are employed when no other anchor in the source or destination is used. This has to do with the convention for reading and using typographic texts. Links

from bibliographical references such as 'see Charles Dickens, *Great Expectations* (London: Penguin, 1996), pp. 123–126' and the like are one example. Here the link leads to an anchor situated to the left at the top of page 123, that is at the very beginning of the destination.[25]

On the web, many link destinations are uniancoral or multiancoral. This is because there is usually an anchor at the top of each web page even when they are mainly spatial. The *default anchor*, as this particular kind of anchor could be called, is generally activated automatically in case no other anchor is used.[26] Default anchors are frequently used in link destinations, and the top of the destination web page is often the part of the page where the user ends up when following a link. With large link destinations, like long typographic texts, the default anchor is made manifest to the user (by the top-left position of the first line displayed) even though she will probably not take any notice of it. The default anchor, however, is also used with smaller link destinations that easily fit into a screen-sized window. But the users notice these even less than the ones in the larger destinations.

There are not only default anchors for incoming links but also default anchors for outgoing links. A digitally published collection of poems, for example, could be arranged so that one poem at a time appears on the screen and, to shift poems, the user must press 'Enter'. Although there is no explicit anchor after the poem, one could say that the link leads from a spot at the end of the poem (default anchor) to the top of the page on which the following poem is displayed (default anchor). Naturally, the existence of default anchors does not necessarily mean that there are no other anchors. In Michael Joyce's hypernovel *afternoon*, for example, many content spaces contain two default anchors (one at the top and another at the end of the text) and several anchors (clickable words).

What is perhaps the most interesting aspect of anchors in digital link destinations is when anchors other than the default anchors are used.[27] These anchors, as well as default anchors, are generally invisible to the users, who only experience the effect of their existence when they are presented with text situated elsewhere than at the top of a page. If, for instance, I want to explain the word "browser" by means of an explanation in "Matisse's Glossary of Internet Terms," I would not create a link to the default anchor at the beginning of the glossary, but to the anchor bringing the user to the word 'browser' and to the comment belonging to it.[28] The web page "Matisse's Glossary of Internet Terms" is a multiancoral

link destination (and source), but there are also uniancoral digital link destinations. These are web pages with no other anchor than the default anchor at the top of the page. An example of a uniancoral link destination in print are footnotes of this kind: "[2] For purely practical reasons, I refer to the user (the reader, the listener etc.) as 'she' throughout the essay".

"Matisse's Glossary of Internet Terms" illustrates the relativity of the term 'link destination'. The entire document with the glossary (the default anchor is used) as well as parts of it (the "word-anchors" are used) may serve as link destination. Here, it is possible to draw a parallel to typographic links where an entire article as well as a section, a paragraph or a single line, etc. within it may serve as link destination. If the entire web page with the glossary of Internet terms is considered a link destination, it is an example of a multiancoral link destination. Likewise, a print article can be considered as a multiancoral link destination since it includes several anchors (footnote numbers, etc.). But also smaller link destinations may be multiancoral; in the example with Matisse's Glossary, the comment belonging to the term 'browser' could be described as a multiancoral link destination.

Linkarium, Exlinks and Adlinks

So far, texts or parts of texts have been described primarily either as link sources or link destinations. In reality, though, many link sources also serve as link destinations and vice versa. A practical term for the analysis of ancoral texts is therefore *linkarium*, which denotes a specific text or part of a text that is ancoral, i.e. that links lead to and/or from.[29] Linkarium is an analytical tool and the concept refers to the textual section, or selection that one has chosen to study linkologically. For natural reasons, a linkarium often coincides with content spaces (editorial, authorial or other) or other divisions of works (in chapters, verses etc.). But in theory, ten footnotes, ten lines or ten chapters of a text may as well be considered linkaria. Thus a linkarium can serve as link source and/or link destination in its entirety and/or in parts, by which follows that linkaria may include linkaria. As a consequence, the web page "Matisse's Glossary of Internet Terms" is a linkarium, but each of the explanations in the glossary could also be considered individual linkaria and analyzed as such.

In the following, links leading from a linkarium are referred to as *exlinks*, while incoming links are labeled *adlinks*.[30] It is important to remember that the number of exlinks and/or adlinks to a linkarium does not necessarily correspond to the number of anchors. The term used here to indicate the existence of exlinks is *exiteral*.[31] Furthermore, by adding 'uni' or 'multi', the number of exlinks can be given. Thus the *uniexiteral* linkarium has only one exlink while the *multiexiteral* linkarium has several. By simply replacing the part of the words specifying the direction of the link, that is 'ex' with 'ad', the terms will instead concern adlinks: *aditeral* signals that there are adlinks, *uniaditeral* that there is one incoming link, and *multiaditeral* that there are several incoming links. It might be possible to establish the exact number of adlinks by examining links within a single work or a selection of works. However, the task is almost insuperable when dealing, for instance with a considerable book collection or the World Wide Web.[32]

In contrast to link sources, which can only be described as uniexiteral or multiexiteral, and to link destinations, which can be either uniaditeral or multiaditeral, linkaria may be characterized as uniexiteral or multiexiteral and uniaditeral or multiaditeral. However, seeing that a linkarium is not necessarily both exiteral and aditeral, terms describing the absence of either exlinks or adlinks are needed. When there are no exlinks from a linkarium, I choose to call it *nonexiteral* and, in analogy, *nonaditeral* if there are no adlinks. A web page within a website that has adlinks but yet no links to other pages, or a dead end in a digital hypernovel, are examples of nonexiteral linkaria. Tables of contents, on the other hand, are often nonaditeral since there are usually links leading from them but not to them.

There are nine possible constellations when combining these six terms to describe the number of exlinks and adlinks, or absence of such. However, the combination of nonaditeral and nonexiteral is theoretically impossible since this would imply that the linkarium had no links and would therefore, per definition, not be a linkarium. In the figure below, the terms and the different types of linkaria are schematically depicted (three arrows indicate multiple links and not specifically three links):
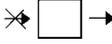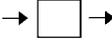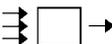
	nonexiteral	uniexiteral	multiexiteral
nonaditeral	[nonancoral text]		
uniaditeral			
multiaditeral			

Figure 2. Types of linkaria.

A uniaditeral multiexiteral linkarium could for example be a footnote of the following type: '[17] Cf. Smith 1998, p. 166 and Johnson 1842, pp. 69-125.' It is uniaditeral because there is one internal link (from the footnote number in the main text) leading to the linkarium, and multiexiteral because there are two external links leading from the bibliographical references, in addition to which there is an internal back link via the footnote number (from the footnote number to the main text). The footnote to which the link from the anchor at the end of this section leads is a uniaditeral uniexiteral linkarium since the link is bidirectional and there are no other links from the footnote.[33]

A Method for the Description of Linkaria

Linkaria may be characterized as either uniancoral, multiancoral or omni-ancoral.[34] In detailed analyzes of linkaria, however, the character of the individual anchors (exiteral, aditeral, or both), as well as the number and the character of the links leading to and/or from these anchors (and thus to and from the linkarium) need to be accounted for. In the schematical descriptions of linkaria the letters 'e' (exiteral) and 'a' (aditeral) will be add-

ed as a subscript to 'A' (anchor) as to indicate whether the anchor is exiteral (A_e), aditeral (A_a) or both ($A_{a/e}$).[35] Omnianchors, '{A}', may also, of course, be aditeral, exiteral, or both: ${A}_a$, ${A}_e$ and ${A}_{a/e}$. The number of links will be marked in Roman numerals after the subscript letters: A_{eI}, A_{aVI} etc.[36] Furthermore, an identification number is necessary to facilitate discussions by individualizing structurally identical anchors. This ID number is placed in a subscript position before the 'A'. The designations of three uniexiteral anchors ($^3A_{eI}$) would then be the following: $_1A_{eI}$; $_2A_{eI}$; $_3A_{eI}$. With anchors that are both aditeral and exiteral ($A_{a/e}$), the ID number and the number of links are indicated similarly: $_1A_{aX/eI}$; $_2A_{aX/eI}$ etc.

In order to describe the character of the links, the types of links and linking must be added to the description of anchors and linkaria. As in the previous schematizations, a link is depicted as an arrow. The different link characteristics are indicated by means of abbreviations, symbols, or a combination of these two. Abbreviations are used for the following concept pairs: digital (dig.) – analog (ana.), internal (int.) – external (ext.), and categorized (cat.) – uncategorized (uncat.) The unbroken line symbolizes a visible link, the dashed line a hidden link and the dotted line an invisible link. Furthermore, the conditional link is marked with the letter 'c' whereas the unconditional link lacks this 'c'.

Finally, as for unidirectional and bidirectional linking, links are depicted as single directed arrows if unidirectional. As discussed above, two links are involved in bidirectional linking. They may either use different anchors in the linkaria (heteroancoral bidirectional linking) or the same anchor (homoancoral bidirectional linking). Homoancoral bidirectional linking, i.e. bidirectional linking where the forward link and the back link use the same anchor in the linkarium, is indicated as follows: '<=>'. The use of two lines in the symbol shows that there are two links involved, making it possible to characterize them separately (one link may, for example, be digital and the other analog, typographic.) The upper line symbolizes the back link whereas the line below symbolizes the forward link. Heteroancoral linking is depicted with two arrows, one indicating which anchor in the linkarium the forward link uses, and the other to which anchor the back link is leading. Because the attention, when analyzing individual linkaria, is focused on that particular linkarium, unidirectional and bidirectional linking will only be discussed in relation to exlinks. As a result, adlinks are always described as unidirectional in descriptions of individual linkaria. Moreover, it should be noted that if a link runs within

a linkarium, the anchor from which, as well as to which the link leads, are indicated.[37]
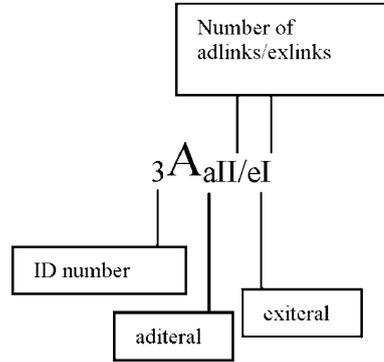
Thus the symbols that are to be used in schematical descriptions of linkaria are the following:

Anchor

A   = anchor

DA   = default anchor

{A}   = omnianchor

$_3A_{aII/eI}$

Number of adlinks/exlinks

ID number

aditeral

exiteral

Links and linking

────────────   visible unconditional link

_..─..─..─..─._   hidden unconditional link

....   invisible unconditional link

──── c ────   visible conditional link

_..─.. c_..─.._   hidden conditional link

.... c ....   invisible conditional link

───────⟩   unidirectional link

⟸═══════⟩   homoancoral bidirectional linking

heteroancoral bidirectional linking

dig.   = digital

ana.   = analog

int.   = internal

ext.   = external

cat.   = categorized

uncat. = uncategorized

Figure 3. Symbols for schematic descriptions of linkaria.

Examples

Finally, three authentic linkaria will be analyzed. The first one is the second footnote of chapter four in Robert L. Pattens' *Charles Dickens and his Publishers* (1978, 75):

> Two major areas of friction can be distinguished. First, Dickens found Bentley's interference in the editorial policy of the *Miscellany* annoying. Dickens's duties as editor were defined by the second of nine Agreements with Bentley [2] made on 4 November 1836. . . .

> [2] The agreements are printed in P [The Pilgrim Edition of *The Letters of Charles Dickens*, ed. Madeline House, Graham Storey, and (vol. iii) Kathleen Tillotson (Oxford, Clarendon Press), 1965–.] i. 648–51, 654–5, 662–4, 666–80; ii. 471–5.

This linkarium is uniaditeral multiexiteral since it only has one adlink, the one that comes from '2' in the main text to '2' in the footnote, but several exlinks (one from each of the bibliographical references and one from the footnote number.) The linkarium is also multiancoral since there are six anchors in all (the footnote number + each bibliographical reference). One anchor is both aditeral and exiteral (the footnote number) while five are exclusively exiteral (the bibliographical references). Thus the footnote can be described as uniaditeral multiexiteral multiancoral [$^1A_{a/e}$; ^5A_e].

Additionally, considering the exact number of links, the aditeral exiteral anchor, $A_{a/e}$, may be characterized as uniaditeral uniexiteral, $A_{aI/eI}$, seeing that there is one link leading to it and another one leading from it. With only one exlink, the five exiteral anchors are all nonaditeral uniexiteral, A_{eI}. The links that lead from the nonaditeral uniexiteral anchors are all typographic (not clickable), external (the link destination is in another work), categorized (there is certain information provided on the link destination), visible, unconditional, and unidirectional (there is no link leading back from the link destination). The link leading from the uniaditeral uniexiteral anchor is also typographic, categorized, visible,

and unconditional but internal (the link destination is within the work) and bidirectionally linked. Seeing that the forward link (the exlink) and the back link (the adlink) are attached to the same anchor, the linking is homoancoral. In fact, since the forward link and the back link also have the same anchor in the main text, this could be described as a bidirectional link (as the linking is homoancoral/homoancoral.)[38] Schematically, the footnote can be depicted as follows:

ana. [typ]/int./cat.
ana. [typ]/int./cat.

$A_{al/el}$

$_1A_{eI}$ ana. [typ]/ext./cat.

$_2A_{eI}$ ana. [typ]/ext./cat.

$_3A_{eI}$ ana. [typ]/ext./cat.

$_4A_{eI}$ ana. [typ]/ext./cat.

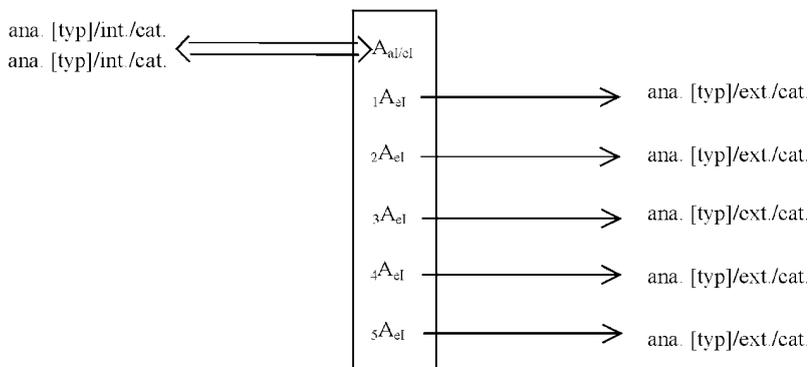$_5A_{eI}$ ana. [typ]/ext./cat.

Figure 4. Schematic description of the second footnote of chapter four in Robert L. Pattens' *Charles Dickens and his Publishers*.

The second linkarium to be analyzed is a web page titled "Mrs. Watson's Baker Street".[39] The page pictures an open fireplace functioning as the table of contents of a fairly small website on Sherlock Holmes. On the mantelpiece, there are clickable items (books, a candle, a note, a photograph, a syringe, and a globe) that may bring the user to other pages of the site. There is also a clickable spider web in one corner of the fireplace.

The link from the globe leads to the page "Mrs. Watson's Baker Street: An Atlas", on which a silhouette of Sherlock, placed in the upper left corner, serves as the anchor of a link leading back to the index page. This silhouette, indicating a link to the index page, is found on all the web pages within the site. Thus, after a few clicks around the site, it is possible to characterize the web page "Mrs. Watson's Baker Street" as a multiaditeral multiexiteral and multiancoral linkarium.

The multiancoral linkarium contains eight anchors – the objects and a default anchor at the top of the page. The seven "object-anchors" so to speak, are nonaditeral uniexiteral ($^7A_{eI}$) since all the adlinks to the linkarium lead to the default anchor. The default anchor is multiaditeral nonexiteral and has no less than ten adlinks (DA_{aX}).[40] These adlinks are all unconditional, digital, internal, categorized (the silhouette of Sherlock gives an idea of the link destination) and hidden (it is not possible to tell whether the silhouette is clickable just by looking at the page.) The links from the nonaditeral uniexiteral anchors are similar to the adlinks. However, because they are exlinks, it must also be indicated whether they are unidirectional links or involved in bidirectional linking. As a matter of fact, in five cases there are links in the destinations leading back to the default anchor in the link source (heteroancoral bidirectional linking.) These links are the ones that lead from the books ($_1A_{eI}$), from the photograph ($_4A_{eI}$), from the globe ($_5A_{eI}$), from the syringe ($_6A_{eI}$) and from the spider web ($_7A_{eI}$). On the other hand, the links from the candle, $_2A_{eI}$, and from the note, $_3A_{eI}$, are unidirectional since their destinations (which are JavaScripts) are not provided with back links. Schematically, the web page "Mrs. Watson's Baker Street" would be described in the following way:
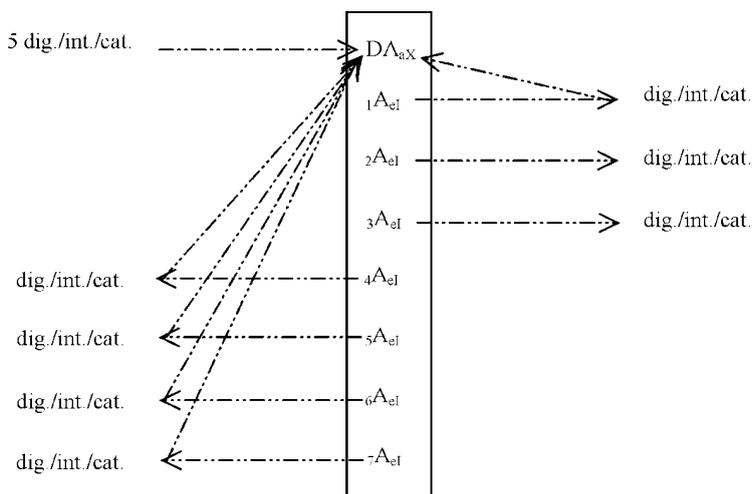

Figure 5. Schematic description of the web page "Mrs. Watson's Baker Street".

Lastly, a linkarium in a computer game will be examined. The linkarium in question is from a children's computer game named *Robinson* in which one of the tasks is to find useful things on a shipwreck.[41] As soon as the task of building a raft has been accomplished the link to the shipwreck will be activated and Robinson will suddenly appear inside the ship in some sort of hallway. There are several rooms to investigate and five items to be collected before Robinson may go back to the shore. If the user tries to make Robinson leave the ship without all the five things in his pockets, the link is unavailable and Robinson says: "– There are still things to be found".

There is only one way into the ship and only one way out, which implies that the linkarium is uniaditeral uniexiteral. Seeing that Robinson leaves the ship from the same spot to which he arrived, the linkarium could be described as uniancoral. The designation of the only anchor in the linkarium is $A_{aI/eI}$. The adlink and the exlink are unidirectional, hidden, conditional, digital, internal, and categorized. The adlink is conditional because the user must first find a way to build the raft and then to make it possible for Robinson to sail on it. The exlink is conditional since it requires that Robinson has collected five things. Described schematically, the shipwreck linkarium in *Robinson* looks as follows:
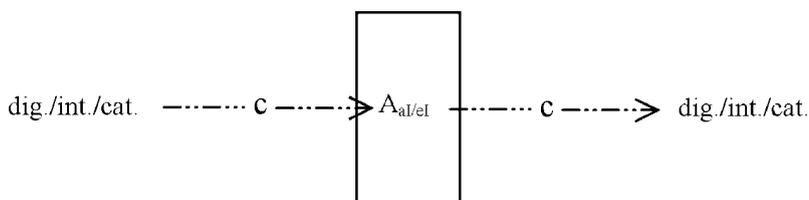

Figure 6. Schematic description of the shipwreck linkarium in the game *Robinson*.

Conclusion

The aim of this article has been to present the nomenclature for a linkology, to provide a terminology facilitating discussions on links and linking in different kinds of works. The terms *link*, *link source*, *link destination* and *anchor* have been discussed, as well as several types of links and linking, namely: *analog link*, *digital link*, *internal link*, *external link*, *unidirectional link/linking*, *bidirectional link/linking*, *unconditional link*, *conditional link*, *visible link*, *invisible link*, *hidden link*, *uncategorized link* and *categorized link*. Furthermore, the following new terms have been introduced: *uniancoral*, *multiancoral*, *omniancoral*, *omnianchor*, *ancoral text*, *nonancoral text*, *linkarium*, *adlink*, *exlink*, *uniexiteral*, *uniaditeral*, *multiaditeral*, *multiexiteral*, *nonexiteral* and *nonaditeral*. Finally, three authentic linkaria have been analyzed and described schematically according to the method presented.

NOTES

(The URL addresses were checked in September 2001)

1. Instead of the English word 'link' one could use the Latin word 'nexus' (something that fastens, a bond, joint, etc. [natural or artificial]; fig. a tie [of kinship or similar]) and speak in terms of a 'nexology' and a 'nexarium' (for what is later defined as 'linkarium'). However, after careful consideration, I have, partly because of the implications of the English word 'nexus', decided to use the English word 'link'.

2. For link discussions of this kind, see for example Tosca (2000), Bernstein (1998), Ricardo (1998), and Walker (1998). See also Miles (1999 & 2000). Naturally, links and linking are also discussed from numerous other perspectives than the ones that are mentioned here. The yearly ACM Conference on Hypertext and Hypermedia is an important forum, where interesting research in the field is being presented, see for example Carr & Hall & Hitchcock (1998), Kaindl & Kramer (1999), Abowd & da Graça Piementel & Ishiguro (2000), Blustein (2000), De Roure & Walker & Carr (2000).

3. In this study, the term *user* designates the person experiencing a work, i.e. the reader, the listener, the player or the viewer. For purely practical reasons, I refer to the user as 'she' throughout the article.

4. As I see it, all man made products are systems of signs. All these sign systems (consisting of, to mention only a few examples, alphanumeric characters, spoken language, music, still pictures or moving pictures) can be considered as texts presenting works. Thus, by 'text' I do not only refer to texts consisting of typographic characters, but also to computer games, web pages, films etc. Cf. Gunder (2001).

5. For a discussion and definition of 'anchor' see for example Koskimaa (2000, Chapter 1).

6. The principles regarding typographic texts that are discussed here may also be applied to other kinds of texts (audible, pictorial, cinematic etc.).

7. There are also analog links that, more or less, bring the link destination to the user: cf. for example the conditional link that has its source in words like 'to be continued' and the like, where the next episode is made available and is presented to the user (in the daily newspaper, on television etc.) at a given point in time.

8. Cf. Jonathan Culler's concept of 'literary competence', (1975, Chapter 6). Cf. the notion of 'hyperliterary competence' in Gunder (1999, 63–65).

9. Once you have read an academic essay, you know what a small superscript number indicates and how footnotes function; once you have surfed the web, you know what underlined words in blue mean and why the cursor sometimes turns into the picture of a small hand.

10. Cf. Svedjedal (2001, 56) Cf. also Kaplan & Moulthrop (1997), who distinguish between 'external links', that lead from one website to another, 'local links', that lead from one web page to another within the same web server, and 'internal links' that lead within one web page.

11. For a discussion on the concept of work see Gunder (2001).

12. It is important to bear in mind that bidirectional linking involves two links and that each of these may constitute a pair, and form bidirectional linking, with several links. In digital texts, for example, it is all but rare that a word like 'back' or something similar has been added in the footnotes serving as anchors for back links. Thus, there are two links leading back to the main text: the typographic link from the footnote number and the digital link from specific word. In other words, the same forward link may be used whereas the back links may differ.

13. The term bidirectional link is somewhat misleading since links, per definition, have a source and a destination and thus connect a place A to B. Nevertheless, it is widely used (cf. for example Landow 1997, 11) and I find it functional if applied in this precise, well-defined manner.

14. For a slightly different view on bidirectional linking and browser functions, see Lynch & Horton (1999, 21).

15. In hypertext theory there are several terms that roughly correspond to Johan Svedjedal's 'content space' (2000, 57). Common terms are, for example, 'lexia' (see for example Landow 1997 and Murray 1997), 'place' (see for example Douglas 2000), and 'node' (see for example Joyce 1995, 189–197). The advantage of the term content space is that it is more general than, for example, lexia (which have strong connotations with the written word) and yet more specific than for example node and place. For a discussion on different kinds of content spaces see Gunder (2001).

16. On the concepts 'ergodic' and 'non-ergodic' see Aarseth (1997).

17. For an overview of different computer games, see Poole (2000). For a discussion on computer games in relation to narration and narratives see also Aarseth (1997), Juul (1999), and Carlquist (2000, 125-176). On computer games and spatiality, cf. Juul (1999) and Aarseth (2001, 152–171).

18. In hypertext theory, links that "signal to the reader what the relationship between the link's anchor (or departure point) and target are" are often referred to as "typed links". Unlike the term categorized links, however, the term typed links is generally restricted to digital links. Categorized links is thus a wider concept including the so-called typed links. The reason why the definition of typed link is not simply modified to include also analog links is that the word 'typed' may easily be misinterpreted in contexts where links in print media are discussed. Cf. for example Landow (1997, 15–16) and Walker (1998, 46; quoted). For a discussion on different types of links see also Nelson (1993, 4/52–4/55).

19. Previously, I argued that links leading from blue, underlined text in web documents are uncategorized. This is often true. From the underlined blue word 'Rod' one cannot tell whether the link leads to a photo of Rod Stewart, a drawing of my dog Rod or a Rod Stewart sound track. However, the URL displayed when holding the cursor over the anchor Rod could reveal some more information, like anna/pets/dogs/rod.htm. Yet it gives no information on the actual character of the link destination – is it an essay, a picture, a song? (This is not to say that the URL cannot contain information of this kind. For example, the file format may reveal if the text is audible or pictorial.) The issue

here is thus whether the interpretation of words, pictures, etc. serving as anchors – the associations tied to certain words – may create a categorized link. Are the blue underlined words 'The New York Times' in a poem a categorized or uncategorized link? I would say that such links feign categorization; the categorization relies on a pure assumption on the part of the reader. I assume that what I associate with the words 'The New York Times' is also what the link leads to. I think that the link destination is the *The New York Times* home page but instead I am presented with a poem titled "The New York Times". Of course this is not clear-cut: if the words were found in italics in an article on newspapers, the link would probably be described as categorized.

20. As to digital categorized links, there are computer programs that implement categorization of links (see for example Landow 1997, 15–16) but, as Jill Walker notes, they can also be constructed individually (1998, 47).

21. A text of this kind is what you expect to find when following a link from a footnote number in the main text.

22. The terms uniancoral and multiancoral are constructed from unus (Lat. one), multus (Lat. many) and ancora (Lat. anchor).

23. Lat. omni = all, whole.

24. An example would be a picture from which it is possible to follow a link by pressing 'enter' (omnianchor is used), but where parts of the picture also are clickable.

25. Page numbers are merely navigational aids helping the user to find the anchor.

26. This default anchor, it should be noted, is set by the computer program in question (the web browsers) and therefore it differs from those created by the author/originator. You could say that it is an instruction that says 'show top of page if nothing tells you otherwise'. Possibly, you could speak in terms of default anchors in print with references of the kind: 'Cf. also Gustave Flaubert, *Madame Bovary*', where the link leads to an anchor at the very beginning of the novel.

27. Nancy Kaplan and Stuart Moulthrop differ between general and specific links. General links "always point to the top of a [web] page," while specific links lead to "a particular point" on a web page. (1997, 2.7.1, 2.7.2).

28. "Matisse's Glossary of Internet Terms" by Matisse Enzer at http://www.matisse.net/files/glossary.html. This reference is a link attached to the default anchor at Matisse's page. If linking to the browser-anchor instead, '#Browser' is added to the URL in the following way: http://www.matisse.net/files/glossary.html#Browser. What is described here are digital anchors in HTML, which could be described as fixed anchors in that they are attached, so to speak, to specific storage signs (like 'c' 'a' 't'). By this follows that changes can be made to a web page without it affecting the position of the anchor; links to the anchor will always lead to the word 'cat'. However, one could easily picture anchors that are unfixed and defined from other premises and, for instance, are attached to the tenth word (no matter if the word is 'cat', 'dog' or 'horse') or to a position in the middle of a certain file.

29. Cf. Vanhoutte's term 'linkem' defined as "the smallest unit of linking in a given paradigm," which is broader than 'linkarium' since it may designate both structural and semantic units. (2000, 121).

30. 'ex' (Lat. out of, from) 'ad' (Lat. toward, to)

31. Where 'ex' (Lat. out of, from) has to do with the direction of the link whereas 'iter', is the Latin word for journey, or way.

32. The reason is that it is often impossible to track down or even to notice a link the back way. For instance, how many links have their destination in *Madame Bovary*, Collection folio (Paris: Editions Gallimard, 1972), page 23? On the web, search engines provide means for searching for web pages linked to a certain web page, i.e. for adlinks. This gives an idea of the number of adlinks to a certain page, but the result must be considered as inexact and approximate. It should be remembered also that the adlinks listed by the search engines exclusively are those leading from other web pages. This means that adlinks from, for example, an article in print is not included. Interesting regarding listing of adlinks in print are the so-called citation indexes, which list not only exlinks, but also adlinks leading to a work, from essays, dissertations, etc. published in certain journals.

33. This footnote is uniexiteral uniaditeral.

34. This information can be included in the schematizations
    (Fig. 2.) by marking uA (uniancoral), mA (multiancoral) or oA
    (omniancoral) in the box representing the linkarium.

35. In fact, in HTML, anchors are technically aditeral or exiteral
    where the former is indicated by 'Name' and the latter by 'Href'
    in the code. However, both attributes can be used with the same
    HTML element. The result is that the same textual element is
    being used as anchor. Considering the perspective chosen for
    this study, I speak in terms of aditeral exiteral anchors in such
    cases.

36. Naturally, regarding the number of links to and/or from the
    individual anchors, the terminology used to describe whether
    there is one, several or no adlinks and/or exlinks leading to/
    from a linkarium may be used. Hence an anchor could, for
    example, be characterized as a uniaditeral uniexiteral anchor or
    a multiaditeral nonexiteral anchor. (Concerning multiaditeral
    and multiexiteral anchors, cf. George Landow's discussion on
    digital link and linking in *Hypertext 2.0* and his distinction
    between one-to-many and many-to-one linking;1997, 13–15).

37. When analyzing several interlinked linkaria, the idea is
    naturally that, when possible, both the source anchor and the
    destination anchor of a link should be indicated. Just like links
    running within a linkarium can be depicted in their entirety in
    descriptions of individual linkaria, links that run between
    linkaria could then be fully described.

38. Note that this cannot be concluded from a schematization of a
    single linkarium since information on both linkaria is necessary.

39. "Mrs. Watson's Baker Street," http://holodeck.vt1.com/holmes/.

40. For obvious reasons only internal links have been analyzed and
    described here, but there are indeed a large number of external
    adlinks as well.

41. *Robinson*, Young Genius Software AB, 1999, ISBN 91-89096-
    39-8.

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