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An investigation of the development of navigation design guidelines for online educational applications delivery to a primary school audience

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Abstract

Despite growing interest in educational websites for children, there has been surprisingly little research conducted into the design of websites intended for a younger audience. This research aims to determine how the design principles identified in the extant body of literature, might be fused with the development practices currently employed within a focus organisation (case study organisation), to synthesise and partially validate a set of website navigation design guidelines for use when developing website navigation for primary school students, between the ages of nine and twelve years.

Keywords

Internet, website navigation, navigation, website usability, children, navigation guidelines, guideline generation.

INTRODUCTION

Navigation involves way-finding; how a user navigates through an environment, to reach an end destination or goal. Within the context of a website, navigation refers to mechanisms to facilitate way-finding; to allow the user to find the desired information within the structure of the website (Fleming 1998). The importance of navigation is twofold: to interface between the underlying information architecture and the user; and to provide clear direction and controls for the user.

The research reported in this paper seeks to build an understanding of the design principles incorporated into the development of navigation systems for educational websites primarily intended for children between the ages of nine and twelve years. The research seeks to examine both the extant literature, and the current practice of a focus organisation to establish the important concepts, principles and processes underpinning design of website navigation functionality for online educational applications intended for the target audience. This paper describes the synthesis, and partial validation of a set of design guidelines, built upon an understanding of the relevant concepts, principles and processes, intended for use by future project managers and developers within the focus organisation.

Whilst there exists a significant body of literature which examines navigation design for general website audiences, the research presented in this paper is motivated by a perceived lack of substantial research and recommendations relevant to the design of website navigation for educational sites intended for children. Website navigation is seen as critical to the success of a website. As such, this research was seen as an opportunity to contribute to an area where real benefits to the information systems discipline might be realised.

The paper is arranged in six sections. The following section provides an analysis of the literature which addresses website navigation design. The research questions, the approach adopted by the study, and the research design is then presented, followed by the results of the research, structured as two sub-sections: initially results related to the process of generating the navigation guidelines are examined; followed by a presentation of exhibits taken from the developed set of navigation guidelines. A discussion section is then presented, leading to some concluding comments.

LITERATURE REVIEW

Despite growing interest in online educational applications for children, surprisingly little research into the development of websites intended for a younger audience has been conducted (Sullivan et al. 2000; Gilutz and Nielsen 2002). It is noteworthy that Gilutz and Nielsen (2002) have reported research built around a series of usability studies focusing on primary school aged children, however there is a distinct lack of literature relevant specifically to the design of navigation for websites intended for children. This review focuses therefore on the

current body of understanding of navigation of general websites, drawing where possible on material relevant to websites for a younger audience.

Hypertext Information Structures and Links

The website structure, or information structure, plays a critical role in determining the navigational system of a website, and therefore influences the design of the user interface (Rosenfeld and Morville 1998). Horton (1990; 1994) identifies four major website structures commonly adopted:

- *Sequence (or linear)* allows navigation either forward to the next node in the sequence, or back to the previous node (Horton 1990);
- *Grid (or matrix)* arranges nodes in a two-dimensional style (i.e. columns and rows), allowing a traversal either up or down vertical links or forwards or backwards (Horton 1990);
- *Web (or star)* positions a node so that a connection with any other node can take place (Horton 1990); and
- *Hierarchical* structure organises nodes into categorised branches, positioned down the hierarchy in a tree-like fashion (Horton 1990; Horton 1994).

In addition to the models of Horton (1990; 1994), alternative hybrid structures are strongly advocated in the literature (Conklin 1987; Nielsen 2000b; Shneiderman and Kearsley 1989; Keeker 1997; Rosenfeld and Morville 1998; Rossi et al. 1999; Farkas and Farkas 2000) to overcome in particular the inherent limitations of a strict hierarchical structure. Specifically, reordering existing structures into "…multiple hierarchies…" (Conklin 1987, p. 35) improves website flexibility, and if used together with a combination of a hierarchical structure with either a web, or sequential component, further increases website navigability (Rosenfeld and Morville 1998).

Farkas and Farkas (2000) suggest that 'Primary Links' define a hierarchical structure, and advocate secondary links to "…augment the primary links" (Farkas and Farkas 2000, p. 346) to provide navigational freedom. Classified as secondary links, 'Shortcut Links' facilitate direct passage between a homepage and important lower-level nodes, while 'Systematic Secondary Links' improve flexibility by providing navigational paths between closely related sibling nodes (Farkas and Farkas 2000). Moreover, to further improve navigability some literature has advocated the possibility of converging links, so a page is accessible from multiple higher level nodes (Farkas and Farkas 2000; Conklin 1987; Shneiderman and Kearsley 1989).

A broad consensus is evident in the literature, favouring the importance of breadth of information structures, over depth. This research stems from the work of Miller (1981), who was amongst the first to examine the relationship between depth and breadth, although Snowberry et al. (1983), Kiger (1984), Schultz and Curran (1986), Gray (1986), Jacko and Salvendy (1996) and Larson and Czerwinski (1998) have made notable contributions. Deep website structure is not favoured when designing for children; a younger user might become frustrated if unable to fully comprehend a site's content (Gilutz and Nielsen 2002).

User Interface Design

The use of graphical or text elements accommodates interaction between the user and the website. Although sometimes perceived as "…merely decoration…" (Barrett et al. 2001, p. 44), the visual user interface (UI) behaves as the intermediary between the website and the user; graphical elements assist to "…construct visual meaning" (Fleming 1998, p. 63), and fuse with the underlying information architecture to provide a coherent user experience and support an effective traversal through the virtual space (Fleming 1998).

Borges et al. (1996) recognise the necessity of designing effectively named links, and suggest that a failure to do so will "…waste user time, discourage exploration and could be responsible for a large amount of unnecessary traffic on the Internet" (Borges et al. 1996, p1). Employing concise description to "… provide a hint on the content of the [following] page …" (Borges et al. 1996, p. 1) is strongly advocated. Further, usability research has identified the negative effect of "…vague or trendy words" (Gilutz and Nielsen 2002, p. 62) when designing the UI, as younger users often skip key navigational links (Gilutz and Nielsen 2002).

Various viewpoints have emerged concerning the use of either text-based or graphic-based navigation mechanisms. While text-based navigation is essential within constantly changing architectures (Rosenfeld and Morville 1998), such navigational mechanisms require an unacceptable number of words to properly describe content (Farkas and Farkas 2000), whereas graphics are often "…processed more quickly and easily than a text link" (Farkas and Farkas 2000, p. 344). Despite such advantages, graphical navigation, unless designed appropriately, can appear ambiguous and affect user performance (Rosenfeld and Morville 1998). Specifically,

graphical mechanisms distract and frustrate children to "…overlook (the) content, interactive elements, and navigational features" (Gilutz and Nielsen 2002, p. 69) of a website.

Through a high degree of user orientation, effective navigation design reduces many of the ambiguities associated with hypertext systems (Landow 1989). Consistent placement of navigational bars and menu items, landmarks (such as page titles) (Krug 2000; Mouty 1999) and link breadcrumbs (Instone 2002), contribute to avoid confusing and frustrating the user (Fleming 1998). While such research has examined general purpose websites, Gilutz and Nielsen (2002) support such claims, suggesting children are better able to navigate when aware of their current position in a website structure.

Navigation bars have become a standard through a wide variety of websites, to provide the user with either a graphical or text based mechanism for moving through the virtual space. Despite the popularity of navigation bars, pull down menu techniques have been identified (Nielsen 2000a), together with graphical menu tabs (Krug 2000), as alternative navigational mechanisms.

Further, advocates of forms of link-to-link navigation have emerged in the extant literature, including specifically: sitemaps which provide a visual representation of an entire website structure; and search functionality which allows the user to specify search terms to facilitate navigation (Farkas and Farkas 2000). Gilutz and Nielsen (2002) criticise the use of overly complex navigational systems, concluding that children are often confused when more than two navigational schemas are incorporated into a website.

In summary, emerging from the above examination of the literature, a number of important navigational options and considerations have been raised, which may be appropriate to the design of website navigation for children. While the majority of the literature reported has focused on the development of websites for general audiences, it is anticipated that many of the principles raised may be relevant to primary school aged audiences.

RESEARCH QUESTIONS, APPROACH AND DESIGN

In accord with the above observations, three primary research questions have been formulated:

1. What concepts, principles and processes of website design should underpin the development of website navigation functionality for online educational applications, aimed at primary school students (specifically students in primary schools in Victoria, Australia), between the ages of nine and twelve years?
2. How might these concepts, principles and processes (from question one) be captured in a guideline form, so they are accessible for other project managers and developers undertaking future online application development?
3. What wider insights might be gained from this research program?

A number of constraints have impacted upon the selection of a suitable research approach, including:

- *Time Restrictions* - A suitable research approach must fit within available time, yet allow for a sufficient level of data collection;
- *Availability of Resources* – A suitable research approach must work within the busy nature of the focus organisation;
- *Nature of the Data* - The research questions favour, at this early stage of the research, the collection of qualitative evidence;
- *Sample Size* – The research must yield credible results drawing upon a small sample population; and
- *Intervention* – The researcher cannot advocate change and demand that certain business practices are adopted.

Following consideration of various candidate research approaches and constraints, a case study methodology appeared the most appropriate. A case study approach is consistent with the need to collect data within a constrained time frame. Recognising the limited availability of resources, and the busy nature of a focus organisation, a case study approach will allow the researcher to collect appropriate data without causing a major disturbance. In relation to the need to collect qualitative data, and in accordance with the recommendations of Yin (1994), a case study is most appropriate for *'who'*, *'how'* and *'why'* questions. In addition, a case study is consistent with the need to collect information about what is happening in a specific context, and where it is possible to access and gain co-operation from the people involved.

Research Structure

To address the three primary research questions, the study was organised according to the following phases:

- *Phase 1:* The initial phase involved investigating the concepts, principles, processes and development guidelines relevant to navigational design, as reported in the extant literature;
- *Phase 2:* This phase involved the collection of case study data, via interviews with employees, together with direct observations of key project meetings, and an examination of existing websites developed by the focus organisation;
- *Phase 3:* The study then sought to synthesise a set of guidelines, drawing together the practices of the focus organisation *(Phase 2*) with material uncovered in the review of the extant literature (*Phase 1*);
- *Phase 4:* The guidelines (*Phase 3*) were then placed with the focus organisation for partial validation, via a focus group session to gain feedback; and
- *Phase 5:* The final phase of the research allowed the researcher to reflect upon the research outcomes from the above stages, and align these with the current body of extant literature.

Selection of Participants and Study Population

The focus organisation selected was a major developer of educational websites for upper primary school age students, within Victoria, Australia. When developing for the target audience, the focus organisation only develop educational websites. Within the focus organisation, four major stakeholder groups were represented in the sample population. These included: Product Managers (PM) who typically liaise with Clients, Graphical Designers and Website Developers concerning management and modifications to websites. Product Managers are the driving force behind website development; Website Developers (WD) participate in both website design (including the design of navigation), and website implementation and coding; Graphic Designers (GD) are principally concerned with the graphical and visual design of a website and the user interface, including the visual representation of the navigation; and Clients (CL) are regarded as content specialists, and design specifically for the target audience. It should be noted that children were not represented in the study population, due to infeasible ethical clearance considerations. The client group (CL) served instead as a highly qualified proxy for the child user group. Clients are responsible for interacting with the target audience to conduct usability testing, and run focus group and discussion sessions, gaining feedback to determine the most appropriate design practices when developing website navigation and website content for the target audience.

Data Collection Instruments

Interviews formed the primary data collection instrument for the study. While an unstructured open-ended interview schedule permits the researcher to "…ask key respondents for the facts of the matter…" (Yin 1994, p. 84) and facilitates a conversational-like discussion (Schatzman and Strauss 1973), unstructured interviews are difficult to conduct and analyse (Bell 1999). For this reason a semi-structured schedule was considered appropriate, with slightly more specialised later sections and pre-defined discussion questions. Interview schedules were based on major issues highlighted from the examination of the extant literature. In filtering the candidate questions, important variations between interview participants were recognised. While a technically orientated interview schedule was suitable for PM's, WD's and GD's, it was deemed inappropriate for the less web savvy CL's; therefore two separate schedules were developed.

Evidence collected from the direct observation of project meetings was aligned with the relevant issues identified from the literature, to clarify how design principles are incorporated when working on an actual project. Finally, the examination of physical artefacts (websites previously designed by the focus organisation) was used as a means of triangulation on the data collection, so addressing, in part at least, issues of bias or post-hoc rationalisation in the data collected by interview and observation.

RESULTS

Process of Guideline Generation

After consulting the focus organisation, interview participants were selected based on previous experience developing for the intended target audience. Following the identification of suitable participants, an invitation and plain language statement were provided. Interview participants included two PM's, two GD's, two CL's, and one WD. The interview process proceeded over a three-week period, with each of the interview sessions ranging from 30min to 80min. Interviews were conducted on-site at the focus organisation, although follow-up emails were necessary to clarify several issues. All interviews were audio recorded and later transcribed.

Data collected by project meeting observation, focused on a series of meetings surrounding the redevelopment of an existing website (not considered during the examination of physical artefacts – see below). Although aimed at a general audience, primary school children are a segment of the intended audience of that site.

Finally, as indicated above, for purposes of data triangulation, five websites developed at the focus organisation were selected, principally based on the intended audience, and examined as physical artefacts. While upper primary school children were not the sole audience of the selected websites, they were considered a major user group in each case. While each site was unique and individual, two websites had similar content, though substantial redevelopment had occurred to clearly differentiate the two samples. The size of the sampled websites differed: two were large sites of over 120 nodes each; one sample was under 100 nodes; while the final two were smaller sites consisting of fewer than 50 nodes.

To assist during the data analysis process, a tabular system was developed to aid the researcher to appreciate the data in a concise fashion. The table used to analyse interview data (Hill 2002) took the form of a matrix with rows listing the major issues identified from the literature. When analysing interview responses the columns list in turn, for each issue, key author contributions, a summary of the responses for each participant, and key quotes from interviews. See Appendix 1 for a sample of the analysis table.

A similar table (Hill 2002) supported the researcher when visiting and navigating through the sample websites to examine physical artefacts. This analysis method allowed the researcher to list, comment, and easily compare the sampled websites against appropriate elements of website navigation design.

The process of analysing project meeting observations was hindered by a lack of suitable data. Although participants discussed many issues regarding the redevelopment during the observed meetings, only a subset of the observed meetings focussed on navigation design. The researcher analysed the data using a similar table (Hill 2002), listing handwritten notes, transcripts of the audio recordings, and key issues uncovered from the literature.

The analysis techniques (described above) supported the generation of the initial version of the guidelines. Specifically, the interview analysis table provided an effective means of comparing interview transcripts, and the relevant contributions from the literature. This table was the key to bringing together the literature, by conveniently comparing and contrasting the contributions from key authors, with the design concepts and principles supported by the focus organisation.

During the formulation of the guidelines an analysis rationale proved valuable when evaluating discrepancies between the positions reported in the literature and those of interview participants. Three circumstances emerged: when interview participant's input aligned with the literature suggestions, the decision was straightforward (the agreed position was included in the guidelines); if disagreement was experienced, the researcher opted for the literature position (if substantial research underpinned the literature advice); otherwise opinions from participants of the focus organisation were represented in the guidelines.

The initial version of the guidelines was organised according to the broad structure of the interview schedule (based on the relevant issues in the literature), though several closely related issues were merged, in the interest of clarity and conciseness, based on careful consideration of the answers of interview participants. A full discussion of the guidelines is to be the subject of a future paper, but in overview the draft guidelines included:

Website Structure; Primary Links; Secondary Links; Systematic Links; Convergence of Hierarchical Branches; The Depth and Breadth of the Website Structure; The Importance of Navigation; Reflection of the Website Structure; Orientating Information; Link Description; Design of Navigation Bars; Text and Graphical Navigation; and Other Navigation.

A subsequent focus group session was convened to partially validate the initial version of the guidelines, seeking critical feedback from the focus organisation. The focus group took place (on location at the focus organisation) in a single 90min session, involving nine participants, an independent meeting facilitator to chair the discussion and provoke and seek development of the presented ideas, and the key researcher. Participants included five PM's, two GD's, one WD and one Backend Programmer (BP) (responsible for backend website coding).

The focus group session was divided into two sections. Initially the facilitator aimed to gain feedback from participants, once the researcher had presented each set of initial guidelines. The meeting operated much like a structured walkthrough. The facilitator provoked, and sought feedback based on a range of factors, including content, understandability, usability, and feasibility (economic & organisational). The meeting was dominated by discussion regarding the guidelines' content, and understandability. Despite the facilitator's probing, matters regarding usability or feasibility (both economic & organisational) did not emerge.

The second section of the discussion dealt with conformance of existing websites developed by the focus organisation to the guidelines. In the time available, the researcher was able to present the comparison of a single website to three of the guidelines. The comparison generated much debate, however, as participants discussed how and why particular decisions were made when constructing that website.

Features of the Guidelines

It is beyond the capacity of the present paper to present full details of the guidelines as they developed. These are to be discussed in detail in a much longer subsequent paper. Several samples are presented, however, from the initial draft guidelines, in Appendix 2, related particularly to issues surrounding Primary, Secondary and Systematic Link usage and Link Convergence - areas that emerged to be of particular significance in the subsequent focus group sessions. This sample highlights the style and content of the quite extensive guidelines that were drafted.

The discussion resulting from the focus group session produced the critical feedback necessary to update the initial version of the navigation guidelines. While many changes were made throughout the document, several noteworthy modifications included:

Merged Content: Two separate sections were merged and heavily modified, due to what was perceived to be a lack of a clear, meaningful distinction between systematic links and converged links, in the minds of the participants. Although the participants understood the importance of both methods, the recommendations of the merged sections were considered somewhat irrelevant, despite strong support from the literature (Farkas and Farkas 2000; Conklin 1987; Shneiderman and Kearsley 1989); and it was believed that existing development practices achieve a similar result. Participants recognised similarity also between sections dealing with "The Importance of Navigation Text" and "Text and Graphical Navigation", as both guidelines reflect on the significance of designing graphical navigation to maximise navigability.

Rearrangement of Content: Participants advocated improved categorisation, where similarities existed between sections. Participants refined and summarised the original recommendations to improve the understandability of the document.

Document Restructure: Participants recognised the importance of considering link descriptions when designing primary or secondary links. Therefore the relevant section was relocated to the beginning of the document. Participants suggested that the rearrangement positioned guidelines relating to link descriptions among several other related issues.

Based on participant feedback, the updated navigation guidelines featured also greater detail in the provision of rationale. Although rationale to support most guidelines was present in the initial version, more detail was requested to illustrate to designers the rules governing the design of navigation. See Appendix 3 for a sample of the revised guidelines, with an enhanced emphasis on the inclusion of rationale.

DISCUSSION

In this penultimate section of the paper we step back from the finer details of navigation design, to a discussion of broader issues resulting from the research.

It was observed that the current development practices of the focus organisation demonstrate a move towards effective design practices, even though the extant literature has little focus on the development of website navigation explicitly for children.

The produced guidelines are intended to support new project development, although the potential to use the research from this study (the guidelines) as a device for website redevelopment was identified. This was highlighted during the later section of the focus group session, when considering the conformance of previously developed websites by the focus organisation to the guidelines produced through this study. Applicability to website redevelopment was demonstrated when considering an examination of two separate versions of a single website (site 1A was the original version of the website, white site 1B was a subsequent redevelopment of the same site).

The redevelopment (site 1B) of the original website (site 1A) illustrated a greater conformance to the navigation guidelines. While site 1A performed poorly compared to the guidelines, a substantial transition occurred when considering the redevelopment of the site. Although site 1B did not fully conform when compared to the guidelines developed through this study, the subsequent redevelopment made significant progress towards compliance with those guidelines.

It must be noted that during the transition from site 1A to site 1B, no intervention or change was advocated by the researchers or the generated navigation guidelines. Differences between the two versions (site 1A and 1B) were simply observed.

This transition illustrates how current development practices of the focus organisation reflected the recommendations indicated in the guidelines. The focus organisation had embraced the essential practices and the importance of designing effective navigational systems for children, even though the output from this study

had not been employed, to date, within the focus organisation. Website redevelopment often involves a complete overhaul of an existing website; the guidelines developed herein would appear to be appropriate to provide direction to future projects when considering the design of navigation in a redeveloped site.

The process of fusing literature based research and recommendations, with the current development practice of a focus organisation has proven an effective model to generating a series of design guidelines tailored to a specific organisation. A number of the practices recommended in the literature, when considered by the focus organisation, generated a great deal of debate between participants. This suggests that the updated guidelines have moved away from documented best practice, although the appropriateness of the guidelines for use in the focus organisation certainly increased in the updated version. From these results, it is suggested this model is suitable for producing organisational- and possibly industry-relevant guidelines. The focus group's partial validation provides confidence that the guidelines are relevant and customised to the specific organisation, while the reliance on literature based research incorporates extant best practice.

Although the model may be appropriate for guideline generation, in this specific case study the contribution from extant literature was criticised by focus group participants. Recommendations regarding the converging of hierarchical branches, while heavily influenced by literature based research, was seen to be lacking in relevance to the focus organisation. Rather, the updated recommendations better reflect current development practice and the opinions of the participants.

CONCLUSION

This research study has made progress towards an improved understanding of the design of navigation for educational applications intended for later primary school students. The study has generated a series of partially validated guidelines, intended for website designers.

The research adopted a case study approach, with five major phases. The first and second phases sought to develop an in-depth understanding of the current principles, practices, and processes underpinning the design of navigation in both the extant literature and a focus organisation. The third and fourth phases of the research concentrated on the generation and partial validation of a series of guidelines. Fusing together the principles from the extant literature, with the current practices of the focus organisation, the research study produced a series of guidelines supporting the design of navigation. A sample of the produced guidelines is presented in Appendix 2. Results from the study have been presented, together with a series of discussion points. In addressing the final phase of the study, a reflection upon wider lessons from the research has been briefly reported.

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APPENDIX 1: INTERVIEW ANALYSIS TABLE – SAMPLE

Research Question	Issues from the literature	Interview questions	PM1	GD1	CL1

RQ 1	***Converging Hierarchical Branches*** Shneiderman and Kearsley (1989) suggested that converging hierarchical branches allow multiple links to point to the same lower level node, allowing a richer network of relationships.	Q: The converging of navigational links allows a website node to be categorised and fit under two logical (higher level) nodes; to what degree is converging incorporated into website design, and what criterion and issues are raised?	PM1 indicated that converging of hierarchical branches does occur when designing websites. The converging does not occur in the primary website navigation, but it is used within the secondary navigation system.	While GD1 has not employed converging, the answer was provided in a hypothetical sense. GD1 suggested that "… the most logical, and the most reasonable, and the most expected outcomes … should be incorporated…" .	CL1 stated that converging of hierarchical branches could be confusing for child users, unless there is a clear method of showing it within the UI. CL1 was unsure of the practicality of the method, and would be careful using it.
RQ 1	***Systematic Links*** *Rossi et al. (1999) and Farkas and Farkas (2000) have described how systematic secondary links are also often used between related sibling nodes, and allow website users to easily traverse between separate hierarchical branches, (without having to navigate back to the top of the branch).*	Q: Are systematic links (or other forms of local navigation) incorporated into current development practice, and under what circumstances are they utilised?	PM1 highlighted the use of systematic secondary links for adult websites, within local text (in text links) so that links can be provided to related content or more information.	The participant was unable to answer the question.	The participant supported the use of systematic links only if the content is similar and related; otherwise there is no need to use systematic links.

APPENDIX 2: SAMPLES FROM THE DRAFT GUIDELINES

Primary Links

Primary links connect a high-level parent node with lower-level child node(s); they define the structure and layout of the website, and form the major navigational passage between website nodes.

Consistency

- Design consistent navigation. This includes consistent placement and grouping, consistent functionality, and the use of similar colours through the website.
- A single design template should be used to ensure consistency.

Represent website branches within navigation

- Primary links to major website categories should be clearly reflected within the primary navigation bar.
- Once a primary link has been selected, secondary navigation bars facilitate navigation to lower level nodes (within the selected category).

Visual separation of navigation with the user interface

- Navigation should be separated and isolated within the user interface, especially when graphically heavy content is incorporated. The visual separation of navigation should be consistently grouped, to avoid relearning navigation.
- The use of larger fonts, colour and icons isolate navigation, and help engage the audience.

Secondary Links

Secondary links provide direct connection to important lower-level nodes, or recently added nodes.

Differentiation within the user interface

- Use 'what's new' sections to link to recently added node(s) from the homepage. This avoids disrupting the website hierarchy.
- 'What's new' sections must be visually separated from other elements in the user interface.
- Use a dedicated window incorporating large and attractive headings, to draw the attention of child users.

Selective use

- Overuse of secondary links may confuse the user, and affect the conceptualisation of the website structure.
- To incorporated important node(s) into a primary navigation system, a re-assessment of the website structure must occur if excessive secondary links are used.

Systematic Links

Systematic links provided a path between a group of closely related siblings nodes.

Branch Traversal

- Systematic links traverse between hierarchical branches; navigation improves with links between categories without having to return to the homepage.
- Users can become confused and lost when using systematic links. Systematic links must be used with caution.

Naming Conventions

- Systematic link naming conventions must imply a scent of the following node's content.

Converging of Hierarchical Branches

Converging combines the directing of multiple links to a single lower-level destination.

Content driven

- Converging is recommended when content fits logically under multiple positions within the website structure; multiple paths lead to a single node.
- To avoid duplicating content, use converging, so offsetting possible subsequent maintenance issues.

Flexibility

- Converging offers alternative paths, so numerous routes lead to website content.
- Converging reduces user frustration by not prescribing a single path of navigation.

Website Structure Conceptualisation

- Converging affects the user's conceptualisation of the website structure. Child users are easily confused when the same content is presented from separate menu items. Converging must be used cautiously.
- To avoid a reliance on converged links, alternative navigation must be provided. (see "Other Navigation")

Visual Categorisation

- Colour categorisation is essential, to group converging menu items within the user interface; visual grouping is important to indicate converged links leading to a single node.
- Users must be able to differentiate between visited and unvisited content, without becoming confused.

APPENDIX 3: UPDATE GUIDELINE STRUCTURE – SAMPLE

5. Effective Content Categorisation and Placement

5.1 Systematic Links
Incorporate systematic links into secondary navigation to provide a pathway to closely related nodes.
Rationale: *Navigation improves with links between nodes, because the user does not have to return to the homepage to find related information.*

5.2 Converging of Hierarchical Branches
If content can be grouped under several categories, use a converging link so the node is accessible from multiple navigation menus.
Rationale: *Converged links offer greater flexibility to the user. Converging provides alternative navigation paths to content, and avoids the website designer prescribing a single route for navigation.*

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