Testing the Visual Consistency of Web Sites

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INTRODUCTION

Large Web sites are often created by teams of developers and designers, coming from different departments and sub-organizations, representing diverse product lines. A clear example of such a large and complex corporate Web site is the Microsoft.com site. The start page (Figure 1) consists of a collection of links to subsidiary sites, which carry the information on the company's product lines. Three clicks on various links show three different subsidiary sites, all of them recognizable as belonging to the Microsoft Corporation, but also clearly distinctive from each other and from the start page. The consistent elements, such as the use of the color blue, the left hand navigation bar and the use of the logo create coherence within and between pages, and between the main site and the subsidiary sites.

The Microsoft Corporation has developed detailed style guides and design templates for its various subsidiary sites and guards their application, whereas at the same time a certain level of variation is intended and promoted. The umbrella organization uses this method to stress both the distinction and the affinity between the various product lines or sub-organizations (van der Geest 2000). One may wonder whether users of these pages notice the mix of consistency and variation. Do visitors of the subsidiary sites still recognize them as a site from the Corporation's family? Or are the visitors just confused, experiencing the variation as inconsistency?

VISUAL APPEARANCE AND CONSISTENCY

Visual appearance has a major effect on how users appreciate Web sites. In a large scale study of Web site credibility, Fogg, Soohoo and Danielson (2002) asked 2,684 people to rate sites and to comment on the aspects that influenced the sites' credibility. The aspect mentioned most often was the sites' visual appearance. Nearly half of all participants in the study (46.1%) referred spontaneously to visual cues, such as layout, typography, and color schemes. Regrettably, comments on inconsistent visual design were not scored separately by the researchers. But we can safely assume that inconsistent visual appearance will lead to lower credibility. Interestingly, experts scored a sub-set of the same Web sites for credibility in a parallel study (Stanford, Tauber, Fogg, and Marable 2002). The experts were far less concerned about the visual appearance of the sites than the users. They rated the sites primarily on the basis of the quality of the information provided.

In another study, Ivory and Hearst (2002) investigated the relation between quantitative, automated measures of Web pages and quality ratings of experts. They found that visual aspects, such as the number of colors used, font size, and the presence of navigation bars, correlated with the quality rating of a site. Apparently, the looks of a Web page are among the prominent, noticeable elements that directly influence interpretation and evaluation (Fogg and colleagues 2002).

Handbooks and guidelines for interface designers stress the importance of consistency, including consistency in visual appearance, mainly from the perspective of creating usable interfaces and Web sites. In his seminal book on user interface design, Ben Shneidermann's first Golden Rule for interface design was "Strive for consistency" (1998, p. 74). In 1989, usability expert Nielsen edited a complete book on the issue, called Coordinating user interfaces for consistency. Most of the early investigators of interface consistency focused on its beneficial effects on ease of learning for initial use of interfaces, and the transfer of learned behavior from one interface to the next.

Grudin (1989) challenged the maxim "Strive for consistency" and made a useful distinction among three types...
of consistency:
- Internal consistency of an interface design, that is, consistency in physical and graphical layout, command naming, dialog forms, and so forth within a particular product
- External consistency of interface features with features of other interfaces familiar to users
- Correspondence of interface features to familiar features of the world beyond computing.

In this article, we will focus on the internal consistency of Web sites. In the world of Web page and site design, the general interface guidelines about consistency are frequently repeated. For example, a set of research-based Web design and usability guidelines recommends "present[ing] information and similar functions consistently throughout the site, including logos, page titles, headers, navigation elements, etc. Also use a consistent position on all pages for logos, recurring text, buttons, and graphics" (National Cancer Institute 2004). The recommendations in the handbooks and guidelines are supported by studies, for example those by Ozok and Salvendy (2000; 2004), who found that increasing the consistency of linguistic and physical attributes of informational Web page interfaces resulted in fewer errors and improved performance by users. So consistency seems to be desirable, but how to assess whether your site is consistent enough for your users, and whether deliberate variation is recognized as such by site visitors?

ASSESSING CONSISTENCY
The literature about assessing consistency shows two approaches: expert-focused and user-focused. In most cases reported, the interfaces or Web pages are evaluated by experts, such as the designers themselves or usability experts. The first part of this section describes in more detail how well experts can assess consistency. Recently, a second approach toward assessing consistency has been promoted. Ozok and Salvendy (2000; 2001) developed a questionnaire, the Interface Consistency Testing Questionnaire (ICTQ), to be filled out by users. The details about testing consistency with this questionnaire are presented in the second part of this section.
Consistency evaluation by experts
How well can experts assess and identify inconsistencies that might create problems for users of a Web site? There is ample evidence that experts are not very successful in predicting the users' self-reported or observed problems with texts, interfaces, or Web sites (Dieli 1986; Doubleday and colleagues 1997; Gahrman 2004; Law and Hvannberg 2002; Lentz and de Jong 1997). Also, among themselves, experts don't agree about the problems identified (Kessner and colleagues 2001; Lentz and de Jong 1997). When detecting inconsistencies is explicitly reported, the experts detect many more inconsistencies than the users (Jeffries and colleagues 1991; Lentz and de Jong 1997).

Does that mean that experts report "false alarms," or could it be that users overlook problems? Maybe inconsistency is one of those product features that experts can pinpoint but that users cannot or will not identify, especially when the inconsistency does not lead to noticeable problems with the execution of the experimental task. We join in with the chorus of authors that advise to consider evaluation by experts and by users as complementary rather than alternative ways of finding problems, particularly because expert review can help to find more skill- and rule-based problems, and testing with users can reveal more problems at the knowledge-based level of behavior (Fu and colleagues 2002; Law and Hvannberg 2002). That still leaves open the question how to do an appropriate user-centered evaluation of visual consistency.

Consistency evaluation by users: The Interface Consistency Testing Questionnaire
Ozok and Salvendy (2000; 2001) developed and validated a questionnaire that measures the consistency of a Web site by users. They distinguish nine factors that affect consistency, such as text structure, meaning, communicational attributes, and physical attributes. The questionnaire consists of 94 yes-no questions which are scored on a seven-point scale, somewhat curiously labeled from "strongly disagree" to "strongly agree." A few examples of questions from the questionnaire are:

3. Are the verbs used consistently?

64. Does the text confuse the user?

89. Are the sizes of the buttons, radio buttons and combo boxes consistent?

Ozok and Salvendy claim that the questionnaire can be used to evaluate the consistency level of interfaces. We have our doubts about the usability of extended questionnaires as Web evaluation instruments in general (de Jong and van der Geest 2000), but even more so about the validity of this particular questionnaire. First of all, the wording of the instrument implies that inconsistency is always bad. We claim that deliberate variation in verbal and visual elements of Web sites can, for example, be used to indicate that the user is entering a new content area in a site. The instrument does not allow for this kind of "intentional inconsistency." Secondly, the questionnaire focuses strongly on the consistency of the verbal content, not surprisingly since Ozok and Salvendy took a questionnaire about Interface Language Consistency as their starting point. Out of 94, only 10 questions are about the visual appearance of the text on screen, 6 are about buttons and dialog boxes, and only 1 question is about the visual consistency between various pages of a site. Given the predominance of visual perception over verbal, one wonders why the questionnaire focuses so much on consistency created by the words and sentences used, and yet claims to measure interface consistency in general. Our final concern about the validity of this approach: Filling out the questionnaire results in a "site grade" for consistency. Such a grade might serve to assess the consistency of a particular site against others (a summative evaluation goal), but neither the grade nor the questionnaire reveals where exactly in the site the inconsistency occurs, and thus will not be of any help to improve consistency or intended variation of the site (a formative evaluation goal). We are more interested in an instrument that shows where users actually experience inconsistency. In the remainder of this article we will report our exploration of one user-centered method, card sorting, for assessing the consistency of visual elements in a set of related Web sites and exploring users' interpretation of the visual cues that create consistency.

THE CARD SORT METHOD
Card sorting is a categorization and classification exercise. In a card sort study, the respondents are given cards with items, for example content elements of Web sites. Then they are asked to order the cards in groups and give the rule by which such allocation is made, by labeling and explaining the groups they have created (Coxon 1999). Card sorting is an easy-to-explain procedure, and it lets the respondents come up with their own classifications and explanations of what "belongs together." The researchers or designers do not impose their classifications and categorizations on the respondents.

In Web site design, card sorting is often applied as a user-centered method for designing the information structure of a site (Faiks and Hyland 2000; Fuccella and Pizzolato 1999; Rosenfeld and Morville 2002; Trooster 2004; van der Geest 2001). For that purpose, the respondents sort cards with content items for the future Web site, and label the groups created. Both the grouping and the labeling give insight in the users' mental model of the information or services provided, and thus can serve as a basis for
designing the site structure and the navigation features. In other domains, such as marketing communication and anthropology, card sorting is used as an elicitation tool with widely varying types of items, such as sounds, pictures and statements. In our case, we explored the method for its appropriateness to reveal users' conceptions of the consistency of visual Web site elements.

THE RESEARCH DESIGN

Through the card sort exercise, we first of all wanted to answer the following question:

**Q1.** Do users recognize (in-)consistency in visual site elements and pages?

This is the question that practitioners want to see answered when they use the card sort method as a user-centered test method. As researchers we had two additional questions:

**Q2.** Can the users indicate and explain the visual cues that make site elements “belong together”?

**Q3.** If so, which visual cues create consistency?

In the process of answering those questions, we will explore the value of a visual card sort for further research into the effects of Web site elements.

For this study, we selected a group of six sites. The main site belongs to a Dutch consortium of higher education institutions; five subsidiary sites belong to schools within the consortium. All sites were created with an organizational style guide and templates provided by the consortium. Although there were obvious commonalities, each school had clearly intended to make its own site with its own flavor and identity.

From each of the six sites, we selected visual page elements like buttons, navigation bars, logos, text layout, and illustrations, for a total of 44 elements. We also selected 24 typical pages, taken from the six sites. We selected elements and pages because they either followed the style guide or clearly deviated from it.

To ensure that the consistency of elements was not assessed on the basis of verbal rather than visual cues, we replaced every word with a similar dummy word and replaced pictures with a generic dummy picture. Figure 2a shows an original page; Figure 2b shows the adapted page. After the adaptations, there was no way to find out from the text, pictures, or pages that a particular element came from a specific school, such as, in this case, the School of Dance.

Twenty students were selected as respondents in our study. They all studied at the University of Twente, but had no graphical design training or experience. Due to the student population in our university, we had mainly male participants (15 out of 20). Twenty respondents appears to be appropriate for a card sort study (Tullis and Wood 2004; Nielsen 2004). Although we were aware of the limitations of using students as participants in our study, we think they formed a good enough sample of experienced Web users for the exploratory study we were conducting.

In the card sorting sessions, we first asked the respondents to sort the 44 elements, which were printed on cards. They were asked to create groups of cards that they felt "belonged together.” During and after the ordering of the cards, they labeled the groups with self-chosen labels. We then asked the respondents to group the 24 pages and label those groups. We also asked them to relate their groups of elements with their groups of pages and label the relationships. This is the part of the study that practitioners would perform when doing a user-centered test of visual consistency.

But to explore the value of the method, we went further. We interviewed the participants about each of their labels, and we asked them to explain what made them decide that items belonged together. Finally, we asked the respondents to take a Web-based test for color blindness, as we wanted to exclude color-blind respondents. None of the respondents proved to be color-blind.
The card sorting session lasted 1 to 1.5 hours for each respondent. All respondents received a token gift for their participation.

Both the ordering of the elements and the grouping of the pages by the 20 respondents were analyzed with cluster analysis (average linkage), a technique to detect patterns in sets of orderings. We used EZSort (IBM, no date) to create the typical tree diagrams that result from cluster analyses. That is what practitioners would do when they conduct a visual card sort. For the sake of this study, we also conducted a quantitative and qualitative analysis of the labels and the interviews to find out how the respondents described and explained their groups.

**Users' Recognition of Inconsistencies**

First of all we wondered whether the respondents would recognize consistencies and inconsistencies in the elements and pages taken from the six related sites. The respondents reported that they did not find it difficult to group the cards with elements and pages, but some of the respondents had trouble labeling the groups and explaining their grouping principles. Our informal observation showed that the respondents widely varied in the amount of time and attention they spent inspecting the cards.

If the respondents had recognized every element and page as belonging together with the other elements from the same original site, they would have created six groups of elements. This proved not to be the case. The 44 elements were on average divided into 13 groups, with a minimum of 6 groups and a maximum of 23 groups. So our 20 respondents had clearly very different opinions about what belonged together. The division of pages remained closer to the original six sites, with an average of 7 groups (minimum of 2 groups, maximum of 9 groups).

The cluster analysis showed which elements and pages were often placed in the same group, and thus belonged together in the perception of our respondents. Figure 3 shows the cluster analysis results for the elements. At the left hand, a list of the elements is shown. The abbreviation at the beginning of the element name shows its origin: Elements with the same abbreviation come from the same original subsidiary site.

The tree diagram shows the *disagreement* among the respondents about whether elements belong together. If all or most of the respondents placed two elements in the same group, those elements are connected at the far left side in the tree, close to 0% disagreement. When very few or none of the respondents placed two elements in the same pile, the elements are connected at the far right side, close to 100% disagreement. For example, the elements that came from the DA subsidiary site (in the middle of the tree) were grouped together by almost all respondents. These elements were internally consistent. But almost every respondent had trouble sorting element 55EL (just above the DA group) which almost never ended up in the same group as any other element. This is a clearly inconsistent item. Also, the other items of the EL site ended up in many different groups, which shows that the respondents did not recognize the elements of the EL subsidiary site as
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consistent.

At the page level, the respondents agreed to a great extent about what belonged together. Figure 4 shows the resulting tree diagram for the pages.

For a few pages, such as 48DA and 64PED, it was not completely clear to all respondents where they belong. Those pages are candidates for further consistency inspection.

From the cluster analysis of the elements (Figure 3) we can conclude that 9 out of the 44 elements are particularly inconsistent, with 70% or more disagreement among the respondents. Four out of those nine elements came from one subsidiary site (EL), which is particularly inconsistent. Two subsidiary sites (EL and PED) are confusingly similar. From the page level analysis (Figure 4), we can conclude that the six sites are distinctive, but two pages, a PED page and a particularly a DA page, are somewhat confusing.

We started this analysis to find out whether a visual card sort is an appropriate technique to reveal the users' perceptions of consistency within and among sites. We think it is. A visual card sort with subsequent cluster analysis is a useful alternative or complement to consistency evaluation by experts. The procedure is not very complicated or time-consuming, and can be executed by practitioners who are not trained researchers.

USERS' LABELS AND EXPLANATIONS OF CONSISTENCY

We also wondered how our users would label and explain their groups—in other words, which cues they perceived as creating the sense of "belonging together." During the card sort exercise, we provided sticky notes for respondents to write their labels. Some respondents chose to label groups with one-word titles, whereas others came up with long and detailed distinctions. We analyzed the labels they attributed to their groups and used the interviews as back-ground information for interpreting the labels.

We saw five different types of labels applied.

1. Descriptive labels (orange, horizontal lines, and so forth)
2. Associative labels (scientific, tranquil, and so forth)
3. Sender- or function-oriented labels (sports club, product information, and so forth)
4. Unlike-the-others labels (for example, a style of its own)
5. Combination labels (for example, color, aggression).

All together, our 20 respondents created 264 groups of elements, and 135 groups of pages. Table 1 shows how often the four types of labels were applied to name the groups.

In the next two parts of this section, we will focus on the two dominant labeling strategies, descriptive and asso-

Table 1: Labeling Strategies of Users

<table>
<thead>
<tr>
<th></th>
<th>Elements</th>
<th></th>
<th>Pages</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N</td>
<td>%</td>
<td>N</td>
<td>%</td>
</tr>
<tr>
<td>Descriptive</td>
<td>133</td>
<td>50</td>
<td>79</td>
<td>59</td>
</tr>
<tr>
<td>Associative</td>
<td>42</td>
<td>16</td>
<td>10</td>
<td>7</td>
</tr>
<tr>
<td>Sender/function</td>
<td>34</td>
<td>13</td>
<td>25</td>
<td>19</td>
</tr>
<tr>
<td>Unlike others</td>
<td>11</td>
<td>4</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Combination</td>
<td>40</td>
<td>15</td>
<td>20</td>
<td>15</td>
</tr>
<tr>
<td>Other</td>
<td>4</td>
<td>2</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Total</td>
<td>264</td>
<td>100</td>
<td>135</td>
<td>100</td>
</tr>
</tbody>
</table>
Descriptive labels of elements
The most common way to indicate that elements belong together is by describing their physical characteristics. Table 2 shows the visual cues that were mentioned in the descriptive labels. Often one label referred to various descriptive cues, for example, font color. In Table 2, such combined cues have been counted twice, once under Font and once under Color. This explains why a total of 133 descriptive labels provided 288 visual cues. The Grid/Navigation category contains all references to the physical appearance of buttons, links, menus, navigation bars, lines, frames, text layout, and screen layout.

According to our respondents, color is the dominant cue to group site elements as "belonging together." It was not only mentioned most often; it was also very often mentioned as the first part of a label.

Associative labels of elements
Elements were sometimes categorized on the basis of some kind of association, such as warm or chaotic. This labeling strategy was mainly applied by 6 out of the 20 respondents. These six used this strategy quite often, creating 36 out of the 42 associative element labels. The other respondents hardly ever referred to an association to label a group. We also saw quite a few combination labels (29 out of 40) in which associative cues appeared with other cues. Respondents, for example, combined associative cues with descriptive cues like orange with associations like warm in one label.

We find the associative labeling strategy interesting for designers of organizational brands. The design process of an organizational image often starts with defining the associations the organization wants to evoke in its communication: dynamic, reliable, caring, and so forth. Cues about such associations appear to be perceived by just a part (6 out of 20) of our respondents. And these respondents also disagree about the nature of the association. For example, a particular element that ended up a few times in groups with associative labels was one time placed in a group called strange, by another respondent in a group called artistic, and by yet another respondent in a group called clear. Although defining corporate identity might be the usual start of the visual design process, it appears that it does not give direction in deciding on the actual physical characteristics of the interface.

Labels of pages
The respondents in our study also created groups of pages, labeled those groups and explained their labels. Just as with the elements, most labels were descriptive (79 out of 135, or 59%). Another labeling strategy was to identify pages as belonging together because they seemed to have the same sender or function (25 out of 135, or 19%). Four out of 20 respondents were responsible for almost all the sender-/function-oriented labels.

The descriptive page labels are shown in more detail in Table 3. The cues are assigned as explained above.

Just as at the element level, the dominant descriptive characteristic to identify pages as "belonging together" is color (92). It was mentioned most often, and when it was mentioned, it appeared often as first cue. Also, character-
istics of the page grid and navigation devices were frequently mentioned (74 times), much more often than at element level, as one might expect.

It surprised us that the logo, which was visible on many of the pages, was used only once to indicate that pages “belonged together.” The logo was a combination of a graphic and type, which in some pages was placed at the left, in other cases at the right hand side. In all cases but one the logo was white, and could be easily distinguished from the various background colors used in the sites. Yet our respondents did not identify it as a feature that created consistency.

Different labels, different groups?
At the element level, 6 out of 20 respondents created the larger part of all associative labels. At the page level, 4 out of 20 respondents were responsible for almost all sender-/function-oriented labels. We checked whether these respondents deviated in their grouping of the cards from the respondents who applied a different labeling strategy. A comparison of the tree diagrams of those respondents that applied an associative labeling strategy for the elements with those that did not showed that the same groups were discerned, independent of labeling strategy. The same proved to be true when we compared the tree diagrams of the four respondents who labeled the page groups on the basis of function/sender with the tree diagrams of the other respondents. Again, the same groups were discerned, even when they were labeled differently.

So even when respondents classify elements or pages on a different criterion (for example, associative *warm* instead of descriptive *orange*), they still discern the same groups of elements as belonging together. We think that this finding is reassuring for designers who want to work from an associative or target group perspective to create a brand or organizational image. It is possible to create site elements and pages from such a perspective and be consistent.

RECOMMENDATIONS FOR DESIGNERS
On the basis of this study we can make some recommendations to those of us who are responsible for guarding or assessing the consistency within or between Web sites.

1. **Be consistent.**
   Although we did not investigate the effect of inconsistency on performance or error rate, there is enough evidence to show that inconsistency can be detrimental. This study shows that inconsistency can be assessed by users, even though they do not mention inconsistencies as problems in other types of studies, such as usability studies in which they verbalize their thoughts and actions while performing tasks.

2. **Use color to signal within-site or between-site coherence.**
   According to the self-reports of our respondents, color is the most important signal to indicate that Web page elements or pages belong together. This included not only the color of the background and bars in the screen design, but also the color of buttons, fonts and lines. A deliberate variation in colors or hues can go a long way to signal users that they are entering a new content area or a subsidiary site. However, overuse of different colors should be avoided (Ivory and Hearst 2002). Also, it should be noted that preferences for particular colors might be tied to culture. Finally, when applying color, designers should be aware of the limitations of color use for people who are colorblind (about 1 out of 12 male site visitors). The Vischeck Web site will display your site as it is perceived by people with three different color deficiencies (Vischeck 2003).

3. **Use grid and navigation elements to create consistency at page level.**
   At the page level, designers should signal consistency through the visual elements that show in the Gestalt of the page, such as the placement of blocks of color and texts; similarity in shape, size, and colors; and application of spacing and lines. The users’ first glance at the page should already reveal its consistency or intended inconsistency. To simulate the users’ first glance, designers should use the “squint test”: When various Web pages are viewed with squinted eyes, the pages should be mutually consistent. A similar test can be conducted by “blurring” the pages in image editing software such as Photoshop.

4. **Don’t rely solely on logos to create a persistent organizational identity.**
   In our study, the logo proved to be only a minor cue for consistency between pages. Very few respondents referred to the logo as a cue to group pages as “belonging together.” This result might be due to the presence of more powerful cues, such as color and page grid. It might also be caused by the qualities of the particular logo used on the pages in our study. Whatever the reason for the limited effect of repeating the logo, our study shows that a logo does not create consistency by itself. Designers should supplement logos with other visual cues to construct a consistent organizational identity throughout Web pages.

5. **For user-centered formative evaluation of consistencies between and within Web sites, consider a visual card sort.**
   As has been demonstrated, the visual card sort offers a clear view of what elements and pages are inconsistent or confusingly similar to each other. When the goal is just detecting inconsistencies, practitioners can limit themselves to
asking the respondents to sort and label the cards. Especially when the tester disposes of the rough visual design elements files, replacing the verbal cues is not too cumbersome. The time-consuming individual interviews and observations that we conducted are not necessary for a simple user-centered consistency check. And the visual card sort can be conducted even more efficiently in group sessions or at a distance, using programs such as WebSort (Wood, Wood and Anderson 2002) or EZSort (IBM, no date).

RECOMMENDATIONS FOR FURTHER RESEARCH

The visual sort method that reveals users’ ideas about the visual elements in Web sites that belong together offers good perspectives for further research. Stripping away all the overt language and graphic elements to render everything that remains as the visual appearance can be a springboard for further studies into the nature and impact of visual Web site elements.

In this study, we focused on the question whether users recognized visual consistency. Further studies could relate the visual elements and their inconsistencies on the one hand with effects such as for example navigation behavior, credibility, or global quality ratings on the other hand. The visual card sort would help the researcher to single out the particular visual elements that could be manipulated (made consistent or kept inconsistent) in various experimental versions of a site. Such studies would deepen our insight into the effects of the various visual elements that now remain hidden under the umbrella label “visual appearance.”

Another issue that could be investigated with the visual card sort method is the relationship between visual preferences and cultural background. In this study, we focused on the visual elements that a narrow group of participants, Dutch university students, found consistent. A comparison of their visual sorts with those of people from different backgrounds or nationalities could reveal whether there are any cross-cultural differences in visual consistency perception and appreciation. Marcus and Gould (2000) claim that people from cultures with a high tendency to avoid risks and uncertainties prefer Web sites that are very consistent. A cross-cultural comparison of visual card sort results could help us to investigate the value of such claims. Knowing whether there are universal patterns of interpretation of visual elements and visual consistency is very useful for designers of Web sites for international audiences.

Obviously, the visual card sort method is an easy way to perform user-centered testing of the visual consistency of Web sites. But the method also offers perspectives for exploring the effective characteristics of visual appearances of Web sites.

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