國立雲林科技大學
九十二學年度研究所博士班招生考試試題

所別：設計學研究所
科目：設計研究方法

說明：本試題共有五大題，請依序並標明題號，詳答於答案卷上，可以不用抄題。
可以中文或英文作答。

一、設計研究方法基本上屬於科學方法。請回答下列問題：
(1) 何謂「科學」(science)？ (5%)
(2) 科學的哲學有三個層次，請闡述其內容？ (10%)
(3) 科學方法具有那些特性？ (10%)

二、何謂「文獻評論」？試申論其目的、重要性，以及基本步驟和重點。(25%)

三、Please try to distinguish among basic, applied, and clinical research (15%) and employ examples to illustrate the differences among them. (10%)

四、請簡述德菲法(Delphi Method)及焦點團體法(Focus Group Method)兩種方法之特質，並說明各方法之實施流程及參與人員之異同？(10 %)　另請以一虛擬課題，說明德菲法如何實際運作。(7 %)

五、何謂內容分析(Content analysis)？其與口語分析(Protocol analysis)之間存在著什麼關係及異同點？(8 %)

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一、設計是一種創造活動，換言之，設計和人的創造力有密切的關係：(25%)
(1) 請為「創造」一詞下定義；
(2) 請說明創造有哪幾種層次；
(3) 和創造力有「負相關」的「人格變項」有哪些？

二、請閱讀 **Color Me Blue... or Red or Green? Lessons from the Literature on Color and Usability** 此篇論文(參見附件)後，簡述論文重點。(10 %) 並請依據此篇論文之相關結果，從各自領域(工業設計、視覺傳達設計或空間設計三者之間，挑選其一)，提出一個與色彩有關研究案的計畫書，其內容需包含前言、研究方法、資料蒐集工具及資料分析技術等。(15 %)

三、行政院於民國九十一年五月三十一日以院臺經字第 0910027097 號函核定『挑戰 2008：國家發展重點計畫（2002－2007）』，在該計畫中共有『十大重點投資計畫』，包括『1. E世代人才培育計畫』、『2. 文化創意產業發展計畫』、『3. 國際創新研發基地計畫』、『4. 產業高值化計畫』、『5. 觀光客倍增計畫』、『6. 數位台灣計畫』、『7. 營運總部計畫』、『8. 全島運輸骨幹整建計畫』、『9. 水與綠建設計畫』及『10. 新故鄉社區營造計畫』等十項。其中的部份計畫及其子計畫與『設計專業』息息相關。請以您個人的『設計專業』，選擇其中的一項重點計畫，論述如何在該重點計畫的概念下，如何貢獻您的專業？並擬定一具體可行的計畫書。(25%)

（下頁續）

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（接上頁）

四、Please write down briefly in Chinese the main arguments of person A and person B (5%), and then, write down your own arguments regarding the same issues. (20%)

A: "All humans design, but in our current western society which is founded on expertism, design is generally understood as something reserved only for experts; this alienates 'ordinary people' from design debate and makes them unnecessarily dependent on the experts."

B: "This is a point I have been making for years and I am happy to see it rearticulated in Kari-Hans' comment. I have also been showing that design and traditional scientific research follows two distinct paradigms that intersect only where problems are conventional and recursive, not innovative. I have found quite a number of members of the design community celebrate scientific or descriptive knowledge at the expense of design or constructive knowledge. In my opinion this undermines what designers ought to be good at."

A: "The society is all the time becoming more design intensive, and the freedom to live, act and realize one's own aspirations is increasingly dependent on designs people have not had a chance to influence, as well as competences to compete in the market through designing. The social and political importance of enabling people to design for themselves, and to participate effectively in the design of things/systems/policies that affect their life, and to make a living designing (to some extent), is growing."

B: "I couldn't agree more with that. It is the ground for participatory design. Not design-for-all but design-by-all?...I guess that would be a little too provocative and also not really feasible. Why not feasible? Surely the fact that all people are speaking a language does not mean that poets are not feasible. But something that indicates the involvement and agenda setting by the stakeholders, but does not carry the baggage of the other terms. For example participatory, user driven, user inspired, democratic, etc. all have connotations and links to other ideas about design that make it hard to discuss the kind of approach you seem to be advocating. But the main point is that to me, the term 'metadesign' has similar problems."

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（附件：共4頁）

Color Me Blue...or Red or Green? Lessons from the Literature on Color and Usability

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Abstract

Color is a complex and powerful phenomenon that can have profound effects on human beings. With the spread of low-cost color technology, many technical communicators, interface designers, and others have the ability to use color in their work, but they may lack basic knowledge of how to use color effectively for their audiences. This paper surveys the literature in technical communication and psychology and suggests ways that color can be used to improve the usability of documents and interfaces.

Introduction

Color is a complicated subject with complex physiological, psychological, and cultural aspects. In addition, there are technological issues present any time we bring color to the computer screen. When we use color in computer interfaces we must consider all these aspects and the ways they interact. Another factor that we must consider, in good Aristotelian fashion, is the product's audience. Users' ages, genders, backgrounds, and states of mind may affect the way they see color and the resonances and associations they have for color.

Can we use the resonances colors have for people to design more usable software for particular audiences? In considering the matter, perhaps it would be useful to adopt a holistic approach that considers the audience's prior experience and psychology as well as traditional design considerations such as Gestalt principles or aesthetics. In the *For Dummies* series of computer books, for example, the yellow-and-black covers are not aesthetically appealing, but they do communicate the idea of "here is a quick and easy way to learn enough to get by" to an audience that has experience with *Cliffs Notes* from their high school or college years. Black and yellow would be a very poor choice, however, for an audience with a phobia of wasps or bees.

Any consideration of color as it appears in the world of experience—color and the usability of computer interfaces included—must deal with the mutability of color under different conditions. Users will, after all, be using their computers under widely varying conditions. This situation is particularly true of users of laptop computers. A given color may not appear the same on the screen when that screen is in a windowless office as it does on a picnic table at the beach. If the colors appear different, then designers must investigate whether they can assume that a usability based on color will remain constant.

Color in Documentation

Murch (1985) brings together technical communication and human factors research to suggest ways we can use color more effectively in documents. He studies the physiology of the human eye and the physics of light to derive a set of guidelines for practitioners in using color.

To avoid fatiguing the reader, Murch recommends, do not use highly saturated and spectrally extreme colors together. To prevent problems with resolution, avoid pure blue for text, thin lines, and small shapes. To create sharp edges, do not use adjacent colors that differ only in the amount of blue. Similarly, do not try to create edges by using color alone. Use color sparingly to preserve its value in grouping, coding, and drawing attention. Conversely, these three areas are where color is at its most useful.

Murch finds that older viewers need higher brightness levels to distinguish colors than younger viewers do, and small changes in some colors (reds, purples, and greens) are harder to detect than small changes in other colors (yellow and blue-green). Red and green are difficult to perceive at the edges of the visual field, so these colors should be avoided near the edges of large-

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scale displays. Contrasting colors produce better displays than analogous ones, and single-color distinctions should be avoided when audience members may be colorblind.

Wurm, Legge, Isenberg, and Luebker (1993) recommend using color for readers or viewers with other types of impaired vision. Their study shows that low-vision viewers can more easily identify objects in colored images than in black-and-white ones when other cues (such as size) are controlled. Using color for text or backgrounds for text, however, does not show the same effect.

Color and the Computer Screen

McVey (1985) recognizes that we cannot directly transfer all of our accumulated knowledge of what makes for legibility from paper to other media. He lists the factors involved: symbol size, width-to-height ratio, stroke width, spacing, brightness contrast, contrast direction, and color and considers them in relation to the newer media of film-based and television display systems.

McVey recommends against using color in displayed visuals without good cause because of physical problems people may have perceiving color (colorblindness and focus problems, for example). On the positive side, color can code information, arouse interest, and hold attention. When color is used, McVey concurs with Murch in cautioning against using highly saturated and spectrally extreme colors together, using blue for text or objects that require good resolution, and using red and green in areas near the edges of viewers' fields of vision. Yellow-reds and yellow-greens are hard to distinguish for some people, McVey finds, as are reddish-blues and greenish blues.

Shneiderman (1992), in his well known text on interface design, addresses both the physiological and emotional/cultural components of color. He recommends using color conservatively and limiting the number of colors used. Overuse of color, he says, can be counterproductive and obscure information and relationships rather than making them clear.

Shneiderman points out that color is a powerful technique for coding and formatting, but it should be used to support the task, should appear with minimal effort of the part of the user, and should be under user control where appropriate. He says that colors have cultural significance that designers must take into account. Even subgroups within a culture may assign their own significances to colors. This author recommends using color changes to indicate changes in status (for example: safe versus unsafe pressures in an oil refinery) or to display more information in the same space (for example: multiple lines on a graph).

Although color is dynamic in the way it appears to humans, it is actually a stable property of surfaces, and humans, through experience, compensate for changing conditions when observing the colors of objects. Arend (1993) investigates the question of whether the light coming from a surface appears the same after the viewer adapts to a new illumination as it did under the previous illumination. Arend takes an experimental approach, investigating his question in the laboratory under controlled conditions and using computer displays to provide the colors. Study participants first memorized four unique hues: red, green, yellow, and blue, each at a constant saturation, then later reproduced those hues plus an achromatic gray under different lighting conditions approximating a range of daylight conditions.

Although Arend does not find a perfect adaptation—the colors do not appear perfectly constant to observers—his participants do come close to reproducing the test hues. He concludes that changes in illumination do alter colors, even within a restricted range of daylights and even after the eye has had a chance to adapt, but the magnitude of these changes is not great. This result is reassuring from an interface designer's perspective. As long as we allow some margin for error, as we should in any case, our designs should be usable in a wide range of environments.

Psychological Effects of Color

The technical communication literature contains little on the cultural and psychological aspects of color as they might be applied to documentation. It might be useful to derive some principles from the literature in psychology and bring them across into technical communication.

Valdez and Mehrabian's 1994 study shows that people find brighter and more saturated colors more pleasant, with brightness having more of an effect than saturation. Colors that are less bright and more saturated tend to be more arousing and induce feelings

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of strength, dominance, and boldness in viewers. These results for brightness and saturation are similar in both men and women, although women consistently showed a "slightly stronger pattern of reactions" (p. 399), possibly because they are more sensitive to changes in brightness and saturation. A program intended for women, therefore, could rely on changes in brightness or saturation as indicators or to make distinctions, but this strategy would not work as well for male users.

Valdez and Mehrabian's viewers also found blues, greens, and purples to be more pleasant than yellows, yellow-greens, and yellow-reds. In general, short-wavelength (cool) colors were rated the most pleasant. Long-wavelength (warm) colors were not as pleasant as the short-wavelength colors, but better than intermediate-wavelength colors. Greens, including yellow-greens and blue-greens, were the most arousing.

The researchers also tested achromatic colors. Black was rated the least pleasant, white the most pleasant, and grays of intermediate pleasantness. Conversely, black elicited the strongest dominant feelings, grays were intermediate, and white elicited the weakest feelings of dominance. Black and white were both arousing (black more so than white), while the grays were less arousing than either black or white.

These emotional effects cannot be ignored. Rather, we can take advantage of them to support users in their tasks. If we are designing instructional programs for audiences who we suspect may find our subjects difficult, unpleasant, or dull, we can use pleasant and arousing colors to counteract these feelings. Perhaps bright and saturated colors could be used to encourage users who might feel intimidated by the computer, although we would want to avoid primary colors that might make such users feel they were being patronized or treated like children. Arousing colors like black, green, and yellow might help reinforce the excitement of a game.

Some of our reactions to colors, like the yellow and black on a *Cliffs Notes* cover, are learned. Hamid and Newport (1989) studied children's reactions to investigate physiological, rather than learned, responses to color. Although pink is said to have a tranquilizing effect on adults, such an effect was absent on the children in the study. Being in a pink room appeared to "increase their physical strength and their positive mood" (p. 184). The researchers attribute this effect to the arousing qualities of the color pink.

Adult office workers in a red room, however, scored higher on an anxiety scale than those working in a blue room, according to a 1988 study by Kwallek, Lewis, and Robbins. Workers in the blue room scored higher for depression. Workers who switched from the red to the blue room or vice versa were the most aroused and made the most typing errors. These results suggest that we should be deliberate in our use of color, not haphazard about it. Arousing colors may be useful in some circumstances—such as physical therapy or physical fitness software—and counterproductive in others—such as a typing tutor or a spreadsheet program.

Ireland, Warren, and Herringer (1992) find that anxious viewers prefer less saturated colors than less anxious viewers. The researchers speculate that anxious people prefer less saturated colors (pastels) either because they are less arousing or because they are less noticeable and "less likely to draw attention to a high-anxious person"(p. 546). This research has obvious implications for interfaces intended for users who may be anxious, whether those users are computer neophytes, sufferers of math anxiety, or perhaps, in the future, users of diagnostic psychological software.

Color is not an Afterthought

Color can affect audiences mentally and physically. It can be a powerful means of conveying information preattentively through Gestalt principles such as grouping or draw on users' prior experience to encode information. It can create interest and excitement or be pleasant, reassuring, or intimidating. It can focus attention, highlight structure, and reinforce a message presented in text. Color can affect the way users work and feel, and users also bring something to their perceptions of color based on their own backgrounds and mental states. When we put color to use to support user tasks, we have to take this complex interplay of physiology and psychology into account.

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Biography

Marilyn R. P. Morgan is a Ph.D. student in communication and rhetoric (scientific and technical communication track) at Rensselaer Polytechnic Institute in Troy, New York. Before beginning her work at Rensselaer she completed internships at Oak Ridge National Laboratory and the University of Tennessee's Energy, Environment, and Resources Center. Currently she is on a cooperative education assignment at NASA's Langley Research Center in Hampton, Virginia. Her professional interests include computer-mediated communication, electronic graphics, and social science research methods.

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