科技部補助專題研究計畫成果報告
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資訊架構、任務複雜度對智慧手機的使用性及表現之影響

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中 文 摘 要 ： 由於行動技術快速發展，近年來行動商務大幅成長，使用行動裝置瀏覽網頁、購物乃現今使用者經常使用之功能。然而使用行動裝置進行購物時，受限於螢幕尺寸較小的限制，頁面呈現資訊量無法比擬網頁型購物網站。在此限制下，如何設計適當的資訊架構，讓使用者能順利、有效率地瀏覽及完成購物資訊收集，已成為行動裝置介面設計上的挑戰。本研究探討不同廣度、深度之資訊架構呈現方式對介面使用性的影響，並檢驗當使用者執行不同複雜度之任務時，資訊架構及使用者之多工偏好是否會影響使用者的任務績效表現。

本研究使用3 x 3三因子混合實驗設計，探討資訊架構、任務複雜度對使用智慧手機之瀏覽表現及操作滿意度的影響。資訊架構呈現方式分為：淺廣、中庸、深窄三種類型；任務複雜度分為：簡單、中等、困難三種不同難度之任務。本研究發現：

1.越深的資訊架構，會增加使用者的迷失感與心智負荷。
2.資訊架構設計，中庸型資訊架構之任務表現最佳，而主觀迷失感與心智負荷則以淺廣型資訊架構評價最好。
3.任務複雜度與任務表現績效成反比。
研究結果顯示存在與資訊架構有關的認知處理，增加資訊架構的深度會使得困難任務更難以執行。本研究成果可做為評估行動商務介面設計之依據。

中文關鍵詞： 智慧手機、資訊架構、任務複雜度、使用性

英 文 摘 要 ： Smart phones have become an integrated content delivery platform for communications. Given the small display interfaces, how to navigate to access information in an efficient way is critical. The study investigated the task complexity, information structure of the smart phones and their interaction effects on usability and navigation performance.
The research findings provide research and practical implications. First, using medium (vs. shallow-wide and deep-narrow) information structure yielded faster task response time, at the expense of higher perceived disorientation and task load, however. Second, while there was no difference between medium and deep-narrow structures in terms of the number of taps for both middle and complex tasks, the corresponding response times differed dramatically. These findings suggest the existence of implicit cognitive processing that is more intrinsically structure related. Finally, task complexity moderates the effect of information structure on navigation performance. The results indicated that increasing the levels of information structure can make complex tasks even more difficult to execute.

英文關鍵詞： smart phone, information structure, task complexity,

usability

目錄

資訊架構、任務複雜度對智慧手機的使用性及表現之影響

摘要

由於行動技術快速發展，近年來行動商務大幅成長，使用行動裝置瀏覽網頁、購物乃現今使用者經常使用之功能。然而使用行動裝置進行購物時，受限於螢幕尺寸較小的限制，頁面呈現資訊量無法比擬網頁型購物網站。在此限制下，如何設計適當的資訊架構，讓使用者能順利、有效率地瀏覽及完成購物資訊收集，已成為行動裝置介面設計上的挑戰。本研究探討不同廣度、深度之資訊架構呈現方式對介面使用性的影響，並檢驗當使用者執行不同複雜度之任務時，資訊架構是否會影響使用者的任務績效表現。

本研究使用 3 x 3 二因子混合實驗設計，探討資訊架構、任務複雜度對使用智慧手機之瀏覽表現及操作滿意度的影響。資訊架構呈現方式分為：淺廣、中庸、深窄三種類型；任務複雜度分為：簡單、中等、困難三種不同難度之任務。本研究發現：

1. 越深的資訊架構，會增加使用者的迷失感與心智負荷。
2. 資訊架構設計，中庸型資訊架構之任務表現最佳，而主觀迷失感與心智負荷則以淺廣型資訊架構評價最好。
3. 任務複雜度與任務表現績效成反比，受資訊架構深度之調節。

研究結果顯示存在與資訊架構有關的認知處理，此外，增加資訊架構的深度會使得困難任務更難以執行。本研究成果可提供行動商務介面設計之依據。

關鍵字：智慧手機、資訊架構、任務複雜度、使用性

The effects of information structure and task complexity on usability and performance of smart phones

Abstract

Smart phones have become an integrated content delivery platform for communications. Given the small display interfaces, how to navigate to access information in an efficient way is critical. The study investigated the task complexity, information structure of the smart phones and their interaction effects on usability and navigation performance.

The research findings provide research and practical implications. First, using medium (vs. shallow-wide and deep-narrow) information structure yielded faster task response time, at the expense of higher perceived disorientation and task load, however. Second, while there was no difference between medium and deep-narrow structures in terms of the number of taps for both middle and complex tasks, the corresponding response times differed dramatically. These findings suggest the existence of implicit cognitive processing that is more intrinsically structure related. Finally, task complexity moderates the effect of information structure on navigation performance. The results indicated that increasing the levels of information structure can make complex tasks even more difficult to execute.

Keywords: smart phone, information structure, task complexity, usability

1 Research motivations and purposes

Smart phones have become an integrated content delivery platform for communications. The increasing capabilities and value-added features of smart phones provide more utilities, and at the same time, make the design more complicated and the devices more difficult to use. Usability is the greatest barrier between what the mobile Internet could be and what it currently is (Nielsen & Ramsay 2000; Venkatesh & Ramesh 2006). Importantly, the user's subjective perceptions of the usability of a mobile device have a great impact on the successful adoption and use of applications (Varnali & Toker 2010; Venkatesh et al. 2003).

Given the small display interfaces, how to navigate to access information in an efficient way becomes more and more crucial. A problem that can occur while gathering information over the mobile phones is cognitive overload (Puerta Melguizo et al. 2012). Another problem that can occur is the feeling of being lost and disoriented (Conklin 1987; Edwards & Hardman 1999). One way to address these usability problems would be to develop an efficient information structure, taking into consideration the limited screen and the complex nature of the tasks users can perform on the mobile devices. In this study, we focus on discussing the task navigation complexity (Gwizdka 2008), information structure of the smart phones (Jacko & Salvendy 1996; Larson & Czerwinski 1998) and their interaction effects on navigation performance and usability. By identifying relationships between information structure and task complexity, the study aims at providing design insights for mobile service providers.

2 Literature review and hypotheses

This section reviews two research areas closely related to the present study: information structure and task complexity. Research hypotheses are proposed based on the theoretical rationale.

2.1 Hierarchical information structure

Five classes of features have been identified as joint contributors to system usability: task features, user features, provider features, system features, and environment features (Fang & Holsapple 2000). Of these, system features are the most controllable (Fang & Holsapple 2007). Several studies have shown that simple hierarchical structures facilitate information retrieval because hierarchical organizations seem to facilitate the construction of a mental map of the hypertext (Edwards & Hardman 1999; Mohageg 1992; van Nimwegen et al. 1999). Currently, information on a mobile screen is mostly presented to users in the form of a strict hierarchy. Mobile users are required to follow paths or links sequentially.

The two key characteristics to be considered in the design of a hierarchical information structure are the depth and the breadth of the menu (Chae & Kim 2004; Henneman & Rouse 1984). Depth is usually defined as the number of levels in the hierarchy, breadth as the number of options per menu panel (Paap & Cooke 1997). A menu is defined as a set of options displayed on the screen, where the selection and execution of one (or more) of the options result in a change in the state of the interface. The characteristics of a menu can have a large influence on selecting the right navigation pathway. Further, the type of menu has been recognized as one of the most important variables affecting task performance (Jacko & Salvendy 1996; Larson & Czerwinski 1998).

2.2 Information complexity

Navigation tasks have been defined as the sequences of actions performed by the searcher in the process of looking for information to satisfy a current information need (Gwizdka & Spence 2006). Instead of task complexity, the term navigation path complexity defined by Gwizdka and Spence (2006, 2007) mainly refers to navigation aspects and does not include other aspects that are more intrinsically task related. These authors introduced an 'objectivised' measure for navigation path complexity that aims to explore the cognitive effort associated with the process of information search. Briefly, they proposed to assess navigation path complexity by breaking it into components related to the content of the visited pages and the navigation path length:

- Page complexity or complexity of the navigation choices on each web page. Page complexity is determined by aspects such as the number of links in a page or the visual design, etc.
- Page information assessment or difficulty to judge the relevance of the information contained in the page in relation to the information goal (Gwizdka & Spence 2006).
- Navigation path length leading to the target information. The more the navigation levels the more relevance judgments need to be made by the searcher, which affect information seeking performance. Studies manipulating path length have found clear effects of this variable (Jacko & Salvendy 1996; Kammerer et al. 2008; Puerta Melguizo et al. 2012). For example, Melguizo et al. (2006) found that path length affected accuracy, time performance and disorientation.

2.3 Trade-offs between hierarchical information depth and breadth

Navigation problems (e.g., getting lost, or choosing an incorrect pathway to a goal) become more severe as the hierarchy grows deeper. A hierarchical structure with several levels requires a user either to recall or to discover a pathway from the present location to the target location. As the depth increases, so does the number of page transactions, that is, the number of movements from one page to another (Paap & Cooke 1997). Each page transaction requires an action from the user (e.g., a click or a tap) and a response from the system (e.g., a change of display). Obviously, each transaction adds to the cumulative response time (Paap & Cooke 1997). In sum, depth in an information structure increases the likelihood of navigational errors, and also decreases execution speed.

Nonetheless, there are good reasons to consider a system with greater depth. Certainly, when the amount of information exceeds the available space, at least some depth must be introduced and, in fact, a structure that favors depth can avoid the crowding brought about by excessive breadth. Crowding (i.e., the presence of more options on a single menu than a user can process quickly) increases the time it takes a user to make his or her selection. Paap and Cooke (1997) have found that a structure that favors depth over breadth can avoid crowding by allowing funneling - that is, a reduction in the total number of options a user must choose among. Funneling can generate efficiency gains, particularly in situations where more cognitive processing is required of users.

Clearly, the balance of depth and breadth in hierarchical information systems affects both user navigation behaviors and user preferences (Chae & Kim 2004). In sum, the advantage of breadth is that it reduces the number of page transactions and navigation errors, whereas the disadvantage that it leads to crowding. The advantage of depth is that it avoids crowding and encourages funneling, whereas the disadvantage is that mobile users are required to perform multiple taps and may commit numerous navigation errors, increasing the number of page transactions (Albers & Kim 2000). On the other hand, as the depth increases, the selectable options decrease so does the required number of flicks. Moreover, in addition to the page transactions necessary to complete a task, users may perform a couple of taps in an attempt to orient themselves, or to provide context as they progress through the text (Dillon et al. 1990). Thus, with greater depth users become lost more easily, leading them to perform more taps in an effort to get their bearings, reducing the performance of information retrieval and satisfaction. We propose

H1: Information structure will influence users' navigation performance.

H1a: Greater depth will increase response time.

H1b: Greater depth will increase taps.

H1c: Greater depth will decrease flick.

H2: information structure will influence users' perceptions.

H2a: Greater depth will increase perceived disorientation.

H2b: Greater depth will increase perceived task load.

H2c: Greater depth will decrease satisfaction.

2.4 Task complexity

Task complexity has been recognized as one of the most important factors in information seeking behaviour (Gwizdka & Spence 2006, 2007). According to Wood's task complexity model (Wood 1986) and the notions of system complexity (Klir 1985; Simon 1962), task complexity is a function of the number of individual parts, the relationships among the parts, and changes in parts and their corresponding relationships. For instance, Melguizo et al. (2012) defined 'fact-finding tasks' as tasks in which the information is directly located in a specific place of a webpage and 'gathering tasks' as those tasks to which the target information is spread out over different paragraphs or pages. As expected, gathering tasks are more difficult and take more time to perform than fact-finding tasks because they require searching information in different pages, selecting and integrating them (Rouet 2003). In addition, gathering tasks are expressed in more general terms and are longer than fact-finding tasks (Gwizdka 2008; Kellar et al. 2007; Kim & Allen 2002; Rouet 2003; Tu et al. 2008). As a result, fact-finding tasks involve more precise searches and less look backs to the question statement (i.e. information goal) (Rouet 2003). We propose that the effect of structure depth on users' navigation activities may vary with the level of task complexity.

H3: Task complexity will influence the relation between information structure and navigation performance.

3 Methodology

Figure 1 depicts the research model. The study takes information structure as an independent variable and task complexity as a moderating variable.

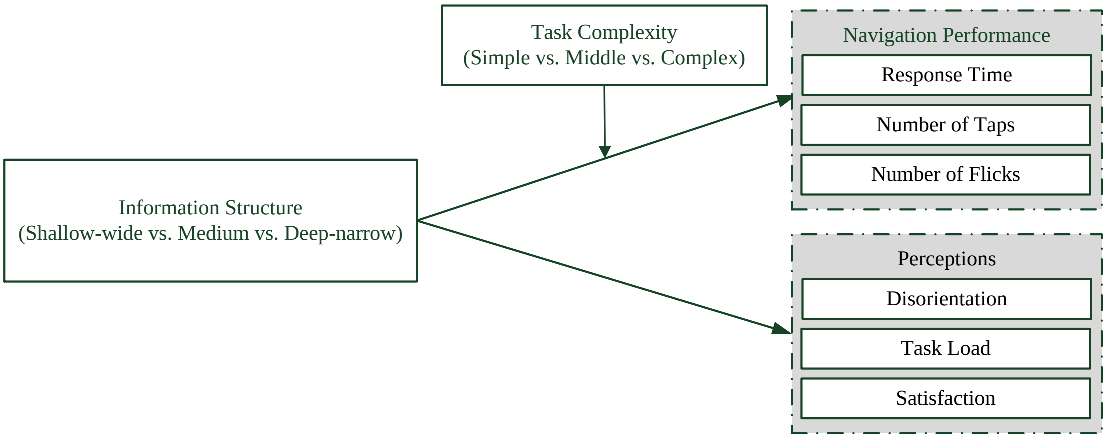


Figure 1 Research model

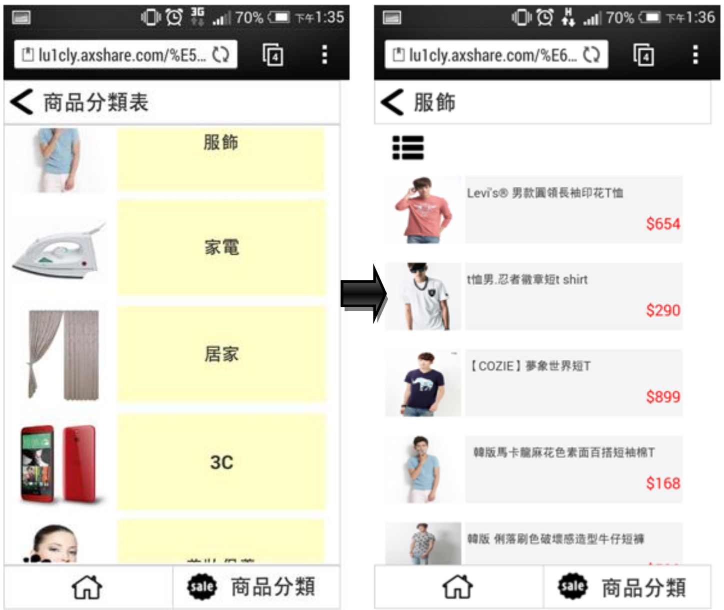
3.1 Participants

One hundred and twenty undergraduate students participated in the experiment. Participants were paid NT$120 (US$1 = NT$30) per hour for their participation. Separate groups of forty participants took part in the three different experimental conditions.

3.2 Experimental design

A 3 (information structure) x 3 (task complexity) factorial design was used. Information structure was used as a between-participants independent variable and task complexity as a within-participant variable. Information structure had three possible types: shallow-wide (two levels), medium (three levels) and deep-narrow (four levels). Task complexity had three possible levels: simple, middle and complex.

Information structure was operationalized by dividing a content list of 256 product items into two, three and four levels versions. As shown in figure 2, in the shallow-wide type information structure, 256 items were organized in a 8 (level 1) -> 32 (level 2) structure. As such, there were 8 categories (level 1) and each product category was linked to 32 selectable options (level 2). In the medium type information structure, 256 items were divided into 4 (level 1) -> 8 (level 2) -> 8 (level 3) structure. There were 4 first-level categories and 8 second-level categories. Each product category at the bottom level was linked to 8 selectable options. In the deep-narrow type information structure, 256 items were divided into 4 (level 1) -> 4 (level 2) -> 4 (level 3) -> 4 (level 4) structure. There were 4 first-level categories, 4 second-level categories, and 4 third-level categories. Each product category at the bottom level was linked to 4 selectable options. In sum, the study manipulated the depth of infomation structure and fixed the total number of items at 256 across all experimental conditions.



Level 1: 8 categories Level 2: 32 options

Figure 2. Illustration of shallow-wide information structure

Three levels of task complexity were designed: simple, middle and complex. In essence, the tasks were to search for products with assigned product information (e.g., find the warranty of the specific brand of air conditioner). The unequivocal information goal was devised such that task completion time and other dependent variables could be measured and compared across different types of information structure, ruling out the influences of individual's preferences during the experimental session. For simple tasks (i.e., one-object search task), in order to acquire the information needed to provide the correct answer, the participant was required to navigate through the information structure and make path relevance judgments in order to identify the single object and relevant information. For middle tasks (i.e., two-objects-one-category search task), the participant must access two objects relevant to the task and the two objects were located in the same product category. Thus, once participants found the first object and relevant information, accessing the second object was much easier since the participant just needed to go one level up and identify where the second object was located. In contrast, for complex tasks (i.e., two-objects-two-categories search task), a participant must access two objects relevant to the task and the two objects were located in different product categories. The participant was required to navigate through the information structure and make path relevance judgments in order to identify the first object and relevant information. In contrast with middle tasks, the process of accessing the second object for complex tasks was identical to initiate a new search.

3.3 Experimental procedure

Participants were randomly assigned to one of the three information structure types (shallow-wide vs. medium vs. deep-narrow). Each participant was assigned 9 tasks (3 simple, 3 middle, 3 complex). Participants were asked to perform the tasks in the same order. The navigation behaviors of each participant were recorded by a digital camera.

After completing all the experimental tasks, pertinent data such as name, sex, education, etc. were recorded. Response time, number of taps, and number of flicks for each task were calculated using the data from the video recorder. In addition, “perceived disorientation” (Ahuja & Webster 2001), “NASA-Task Load Index” (NASA-TLX) (Hart & Staveland 1988), and “Questionnaire for User Interaction Satisfaction” (QUIS) (Chin et al. 1988) were measured on a seven-point scale.

4 Results

This section describes the results of the study. The results of objectively measurable navigation performance were drawn from the video log, while the results of subjective perceptions with regard to information structure were based on the questionnaire responses.

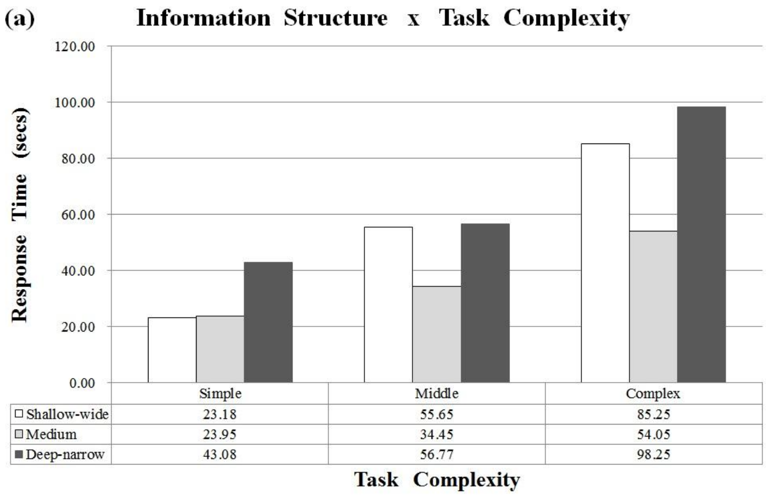
4.1 Navigation performance

A 3x3 mixed ANOVA was used to examine the effects of information structure and task complexity on users’ navigation performance (i.e., response time, taps, and flicks).

The analyses revealed the main effect of information structure on response time ($F(2, 117) = 867.490$, $P = 0.000 < 0.05$), taps ($F(2, 117) = 191.480$, $P = 0.000 < 0.05$), and flicks ($F(2, 117) = 1268.313$, $P = 0.000 < 0.05$). Specifically, task response time was faster when using medium structure (M = 37.48, SD = 15.37), then shallow-wide structure (M = 54.69, SD = 25.97), and slower when using deep-narrow structure (M = 66.03, SD = 24.64). The number of taps increased as the levels of information structure increased, with averages of 4.64 (SD = 1.29), 8.26 (SD = 3.85), and 8.46 (SD = 5.22) for shallow-wide, medium, and deep-narrow structures, respectively. In contrast, the number of flicks decreased as the levels of information structure increased, with averages of 11.63 (SD = 6.89), 6.10 (SD = 3.12), and 3.05 (SD = 1.71) for shallow-wide, medium, and deep-narrow structures, respectively. Post hoc analyses showed that three types of information structure differed significantly in terms of response time and flicks, with H1a partially supported and H1c supported. While the number of taps was fewer for shallow-wide structure, there was no difference between medium and deep-narrow structures, partially supporting H1b.

The analyses revealed the main effect of task complexity on response time ($F(1, 117) = 6155.586$, $P = 0.000 < 0.05$), taps ($F(1, 117) = 410.439$, $P = 0.000 < 0.05$), and flicks ($F(1, 117) = 882.936$, $P = 0.000 < 0.05$). Overall, as task complexity increased, response time, number of taps and flicks increased. Specifically, the response time increased as task complexity increased, with averages of 30.07 (SD = 10.32), 48.96 (SD = 12.82), and 79.18 (SD = 20.74) for simple, middle, and complex search tasks, respectively. The number of taps increased as task complexity increased, with averages of 4.17 (SD = 0.92), 7.13 (SD = 4.84), and 10.07 (SD = 3.36) for simple, middle, and complex search tasks, respectively. The number of flicks increased as task complexity increased, with averages of 3.96 (SD = 2.31), 6.683 (SD = 6.57), and 10.13 (SD = 5.52) for simple, middle, and complex search tasks, respectively. Post hoc analyses showed that three levels of task complexity differed significantly in terms of response time, taps, and flicks.

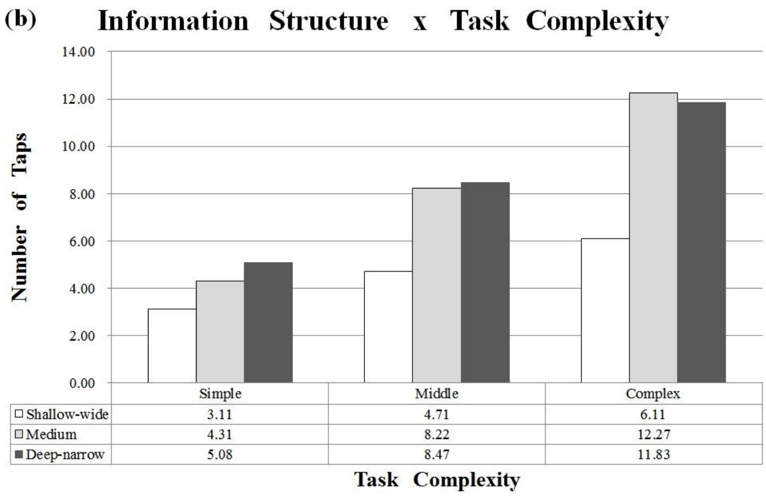
The analyses revealed the interaction between information structure and task complexity on response time ($F(2, 117) = 303.146$, $P = 0.000 < 0.05$), taps ($F(2, 117) = 26.286$, $P = 0.000 < 0.05$), and flicks ($F(2, 117) = 127.366$, $P = 0.000 < 0.05$), supporting H3.



Simple tasks:
① shallow = medium < ② deep

Middle tasks:
① medium < ② shallow = deep

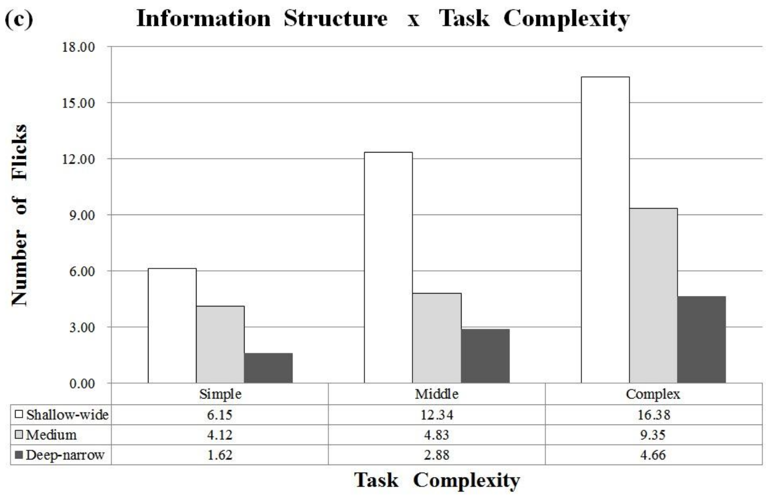
Complex tasks:
① medium < ② shallow < ③ deep



Simple tasks:
① shallow < ② medium < ③ deep

Middle tasks:
① shallow < ② medium = deep

Complex tasks:
① shallow < ② medium = deep



Simple tasks:
① deep < ② medium < ③ shallow

Middle tasks:
① deep < ② medium < ③ shallow

Complex tasks:
① deep < ② medium < ③ shallow

Table 1. Interaction between information structure and task complexity on response time, number of taps, and number of flicks

As shown in table 1 (a), post hoc analyses showed that for simple search tasks, response time was faster when using shallow-wide (M = 23.18, SD = 3.59) and medium structures (M = 23.95, SD = 4.88), which differed significantly from deep-narrow structure (M = 43.08, SD = 5.31). For middle search tasks, response time was faster when using medium structure (M = 34.45, SD = 7.71), which differed significantly from shallow-wide structure (M = 55.65, SD

= 7.67) and deep-narrow structure (M = 56.77, SD = 7.68). For complex search tasks, response time was faster when using medium structure (M = 54.05, SD = 4.27), then shallow-wide structure (M = 85.25, SD = 4.27), and slower when using deep-narrow structures (M = 98.25, SD = 8.94).

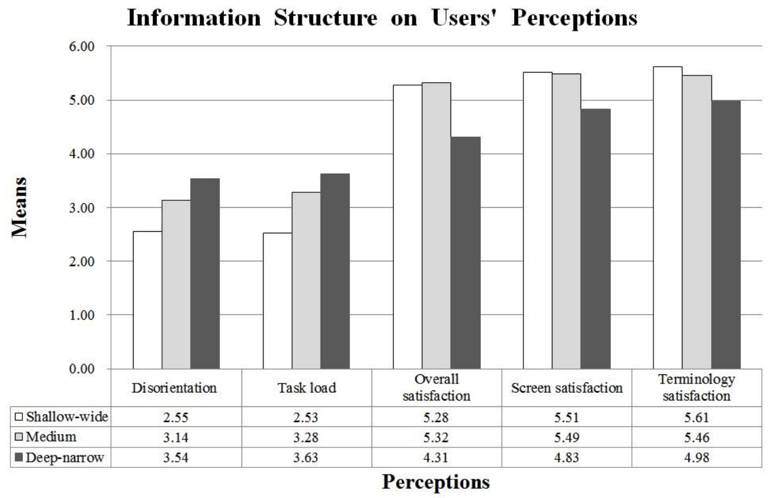
As shown in table 1 (b), post hoc analyses showed that for simple search tasks, the number of taps was fewer when using shallow-wide structure (M = 3.11, SD = 0.34), then medium structure (M = 4.31, SD = 0.53), and more when using deep-narrow structure (M = 5.08, SD = 0.31). For middle search tasks, the number of taps was fewer when using shallow-wide structure (M = 4.71, SD = 0.49), which differed significantly from medium structure (M = 8.22, SD = 1.98) and deep-narrow structure (M = 8.47, SD = 7.59). For complex search tasks, the number of taps was fewer when using shallow-wide structure (M = 6.11, SD = 0.38), which differed significantly from medium structure (M = 12.27, SD = 2.91) and deep-narrow structure (M = 11.83, SD = 1.29).

As shown in table 1 (c), post hoc analyses showed that for simple search tasks, the number of flicks was more when using shallow-wide structure (M = 6.15, SD = 1.48), then medium structure (M = 4.12, SD = 1.69), and fewer when using deep-narrow structure (M = 1.62, SD = 0.79). For middle search tasks, the number of taps was more when using shallow-wide structure (M = 12.34, SD = 8.52), then medium structure (M = 4.83, SD = 2.23), and fewer when using deep-narrow structure (M = 2.88, SD = 1.52). For complex search tasks, the number of flicks was more when using shallow-wide structure (M = 16.38, SD =3.88), then medium structure (M = 9.35, SD = 2.33), and fewer when using deep-narrow structure (M = 4.66, SD = 1.09). Overall, the number of flicks decreased as the levels of information structure increased. Post hoc analyses showed that three types of information structure differed significantly across the three levels of task complexity.

4.2 Perceptions

A one-way ANOVA was used to examine the effect of information structure on users' perceptions (i.e., perceived disorientation, perceived task load, and satisfaction). QUIS was adapted to measure perceived satisfaction. Specifically, satisfaction in the present study was assessed by 'overall reaction ratings of the system' (overall satisfaction), 'screen factors' (screen satisfaction), 'terminology and system information' (terminology satisfaction), 'learning factors' (learning satisfaction).

The analyses revealed the main effect of information structure on perceived disorientation ($F(2, 117) = 9.232$, $P = 0.000 < 0.05$), perceived task load ($F(2, 117) = 8.469$, $P = 0.000 < 0.05$), overall satisfaction ($F(2, 117) = 13.376$, $P = 0.000 < 0.05$), screen satisfaction ($F(2, 117) = 5.027$, $P = 0.000 < 0.05$), and terminology satisfaction ($F(2, 117) = 5.070$, $P = 0.000 < 0.05$). However, the effect of information structure on learning satisfaction was not significant ($F(2, 117) = 2.376$, $P = 0.097 > 0.05$).



Disorientation:
① shallow < ② medium = deep

Task load:
① shallow < ② medium = deep

Over satisfaction:
① shallow = medium > ② deep

Screen satisfaction:
① shallow = medium > ② deep

Terminology satisfaction:
① shallow > ② deep
medium = shallow
medium = deep

Table 2. Effect of information structure on users' perceptions

As shown in table 2, as the levels of information structure increased, users' perceived disorientation and task load increased, whereas satisfaction decreased. Post-hoc analyses revealed that while perceived disorientation and task load were lower for shallow-wide structure, there were no differences between medium and deep-narrow structures, partially supporting H2a and H2b. With regard to overall satisfaction and screen satisfaction, there was no difference between shallow-wide and medium structures, whereas the deep-narrow structure was the least satisfied. Further, terminology satisfaction was higher for shallow-wide structure than for deep-narrow structure. Differences with medium structure were not significant. Thus, H2c was partially supported.

5 Discussion

The study investigated the effects of information structure and task complexity on information search tasks that required gathering information from different locations in a mobile application. While task response time has frequently been measured as objective navigation performance in previous research, the number of taps and flicks are measured in this study. In addition, subjective measurements involve negative (i.e., disorientation, task load) and positive affects (i.e., satisfaction). Introducing these measurements is important as they provide different insights about interactions with mobile application. The difference in role can account for the different navigation performance and perceptions caused by the independent factors or the interaction between dependent variables. The research findings provide research and practical implications.

First, using medium (vs. shallow-wide and deep-narrow) information structure yielded faster task response time. For practical purpose, this finding indicates that devising proper levels of information structure increases task performance. However, perceived disorientation and task load were lower for shallow-wide structure than for medium structure. To find a possible explanation for the inconsistency between objective and subjective measurements, a closer look on the other variables was taken. It is likely due to more number of taps being required for medium (vs. shallow-wide) structure, as each tap required an information goal relevance judgment which might increase processing load. Moreover, we assume that one more level with medium (vs. shallow-wide) structure increased perceived depth and feelings of disorientation. Thus, while task response time was faster when using medium structure, no differences in all satisfaction aspects were found between medium and shallow-wide structures. More studies can be done to resolve the trade-off between quicker response time (i.e., increase one level of information structure) and decreased subjective affects (i.e., increase perceived disorientation and task load).

Second, while there was no difference between medium and deep-narrow structures in terms of the number of taps for both middle and complex tasks, the corresponding response times differed dramatically. These findings suggest the existence of implicit cognitive processing that is more intrinsically structure related.

Finally, task complexity moderates the effect of information structure on navigation performance. Overall, as task complexity increased, response time, number of taps and flicks also increased. However, the increasing rates differed across the three types of information structure. Specifically, while no response time difference between shallow-wide and medium structures for simple search tasks, using medium (vs. shallow-wide) information structure yielded faster response time for middle and complex search tasks. On the other hand, while no response time difference between shallow-wide and deep-narrow structures for middle search tasks, shallow-wide structure yielded faster task response time than deep-narrow structure for complex search tasks. These results indicated that increasing the levels of information structure can make complex tasks even more difficult to execute.

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附件五

科技部補助專題研究計畫出席國際學術會議心得報告

日期：104 年 7 月 26 日

計畫編號	MOST 103-2410-H-343-004		
計畫名稱	資訊架構、任務複雜度對智慧手機的使用性及表現之影響		
出國人員姓名	吳梅君	服務機構及職稱	南華大學　資訊管理學系 助理教授
會議時間	104 年 7 月 22 日至 104 年 7 月 24 日	會議地點	Tokyo, Japan
會議名稱	(中文) 國際經濟與社會科學研討會 (英文) International Symposium on Economics and Social Science		
發表論文題目	(中文) 智慧手機之使用性研究：資訊架構與任務複雜度之影響 (英文) Usability of smart phones: Influences of information structure and task complexity		

一、　參加會議經過

本屆 International Symposium on Economics and Social Science (ISESS)乃由 4 個不同研究主軸所組成的國際研討會。會議地點為日本東京，會議舉辦日期為 7 月 22 日～7 月 24 日。

本次發表論文題目為” Usability of smart phones: Influences of information structure and task complexity”，除參與報告的 session 外，也參加不同主題的 session。會議期間，每天的活動行程從早上 8 點半開始，到晚上 6 點方休。每天有 5 個論文報告場次，每個報告場次有 3~4 個不同之主題同時舉行，每場報告 1 個半小時，由 5 位研究者發表論文，可見本研討會之內容相當多元化，不同領域之研究者可自行選擇其感興趣之主題參與，以利學者在會場待上一整天、進行跨領域交流。此外，每天有 3～4 場的壁報論文（poster）可讓正在進行中的研究（Research in progress）學者得以和與會的學者進行面對面的互動交流。在壁報論文（poster）發表時段由於可與研究者進行面對面之交流，得以與研究者進行更深入的互動與討論，更能了解研究者於研究過程中遭遇的困難及重要的發現。

二、 與會心得

1. 企業使用社交媒體行銷究竟能產生多少效益呢？一位研究者透過線上研究，發現現場音樂演奏的社交媒體行銷對於使用社交媒體的群族並無太大的影響力，多數會聽現場音樂演奏的人有其訊息來源，而非從社交媒體獲取，此亦表示企業在運用社交媒體行銷時，或許應考慮其客群的特性，了解其獲得訊息的管道，才能有效達成預期效益。此外，會場中有另一位研究者分享其遇到社交媒體問卷資料收集之困難點，例如，使用便利的滾雪球方式常常收到的資料多為學生族群，這些資料或許並不是研究者真正關注的目標族群。兩位研究者共同交流並得出適時的到實際的場地（ex. 音樂演奏會場）或許是解決資料收集困境的做法。
2. 一位來自成功大學的教授分享其研究品牌認同對忠誠度及購買意圖之影響，有別於其他研究專注於知覺價值對忠誠度及購買意圖之影響，此研究者認為品牌認同是消費者將品牌與自己產生聯結及展現自我的方式，因此更能有效預測消費者的忠誠度及購買意圖。其研究突顯出個人之本體意識對行為及態度之重要意義。
3. 此外，運動旅遊、醫療旅遊、宗教旅遊也漸漸受到各國的關注，分析不同之消費者族群對於不同的旅遊需求，以產生因應之道對於經濟成長有一定之助益。

三、 發表論文全文或摘要

Smart phones have become an integrated content delivery platform for communications. Given the small display interfaces, how to navigate to access information in an efficient way is critical. The study investigated the task complexity, information structure of the smart phones and their interaction effects on navigation performance and usability.

The research findings provide research and practical implications. First, using medium (vs. shallow-wide and deep-narrow) information structure yielded faster task response time, at the expense of higher perceived disorientation and task load, however. Second, while there was no difference between medium and deep-narrow structures in terms of the number of taps for both middle and complex tasks, the corresponding response times differed dramatically. These findings suggest the existence of implicit cognitive processing that is more intrinsically structure related. Finally, task complexity moderates the effect of information structure on navigation performance. The results indicated that increasing the levels of information structure can make complex tasks even more difficult to execute.

四、 建議

International Symposium on Economics and Social Science (ISESS)目前邁入第 3 年，由於包含主題相當廣泛，同時進行多個主題，並可讓與會者自由參加任何一場研討會，因此，對我

們來說是一個不錯的觀摩。唯可惜的是，目前未能在研討會開始前於網站上提供論文摘要，讓與會者能在出席研討會前先行研究要聽取的報告場次。

在壁報論文（poster）互動交流時，受限於會場場地太小，無法讓報告者和與會的學者進行順暢的互動交流。此外，論文發表會場空間不足，有些與會者想聆聽報告卻無足夠空間而作罷，很是可惜。整體而言，本次研究會在會議空間及動線規劃上略顯不足，未來國內舉辦研討會單位應當避免。

五、 攜回資料名稱及內容

1. (CD) Conference Proceedings of the International Symposium on Economics and Social Science (3rd ISESS), Tokyo, Japan, 22-24 July.
2. Conference Program

科技部補助計畫衍生研發成果推廣資料表

日期:2015/10/26

<table>
<tr><td rowspan="3">科技部補助計畫</td><td colspan="2">計畫名稱: 資訊架構、任務複雜度對智慧手機的使用性及表現之影響</td></tr>
<tr><td colspan="2">計畫主持人: 吳梅君</td></tr>
<tr><td>計畫編號: 103-2410-H-343-004-</td><td>學門領域: 資訊管理</td></tr>
<tr><td colspan="3">無研發成果推廣資料</td></tr>
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103年度專題研究計畫研究成果彙整表

計畫主持人：吳梅君			計畫編號：103-2410-H-343-004-				
計畫名稱：資訊架構、任務複雜度對智慧手機的使用性及表現之影響							
成果項目			量化			單位	備註（質化說明：如數個計畫共同成果、成果列為該期刊之封面故事...等）
			實際已達成數（被接受或已發表）	預期總達成數（含實際已達成數）	本計畫實際貢獻百分比		
國內	論文著作	期刊論文	0	0	100%	篇	
		研究報告/技術報告	0	0	100%		
		研討會論文	2	2	100%		
		專書	0	0	100%	章/本	
	專利	申請中件數	0	0	100%	件	
		已獲得件數	0	0	100%		
	技術移轉	件數	0	0	100%	件	
		權利金	0	0	100%	千元	
	參與計畫人力（本國籍）	碩士生	6	6	100%	人次	
		博士生	0	0	100%		
		博士後研究員	0	0	100%		
		專任助理	0	0	100%		
國外	論文著作	期刊論文	0	0	100%	篇	
		研究報告/技術報告	0	0	100%		
		研討會論文	2	2	100%		
		專書	0	0	100%	章/本	
	專利	申請中件數	0	0	100%	件	
		已獲得件數	0	0	100%		
	技術移轉	件數	0	0	100%	件	
		權利金	0	0	100%	千元	
	參與計畫人力（外國籍）	碩士生	0	0	100%	人次	
		博士生	0	0	100%		
		博士後研究員	0	0	100%		
		專任助理	0	0	100%		
其他成果（無法以量化表達之成果如辦理學術活動、獲得獎項、重要國際合作、研究成果國際影響力及其他協助產業技術發展之具體效益事項等，請以文字敘述填列。）	1. 本計畫執行期間，以研究計畫經費補助科技部大專學生研究計畫之執行（103-2815-C-343-001-H，黃朝煒，符合使用者經驗之腎臟病自我健康照護App之研究、設計與開發），期間投入大量時間完成計畫，並獲得【科技部 大專學生研究計畫研究創作獎】之殊榮。 2. 此外，將大專學生研究計畫成果投稿至國際研討會，訓練大學部學生黃朝煒以英文在研討會中發表其科技部大專學生研究計畫成果。						

	成果項目	量化	名稱或內容性質簡述
科教處計畫加填項目	測驗工具(含質性與量性)	0	
	課程/模組	0	
	電腦及網路系統或工具	0	
	教材	0	
	舉辦之活動/競賽	0	
	研討會/工作坊	0	
	電子報、網站	0	
	計畫成果推廣之參與（閱聽）人數	0	

科技部補助專題研究計畫成果報告自評表

請就研究內容與原計畫相符程度、達成預期目標情況、研究成果之學術或應用價值（簡要敘述成果所代表之意義、價值、影響或進一步發展之可能性）、是否適合在學術期刊發表或申請專利、主要發現或其他有關價值等，作一綜合評估。

1. 請就研究內容與原計畫相符程度、達成預期目標情況作一綜合評估

■達成目標

□未達成目標（請說明，以100字為限）

　　□實驗失敗

　　□因故實驗中斷

　　□其他原因

說明：

2. 研究成果在學術期刊發表或申請專利等情形：

論文：□已發表 □未發表之文稿 ■撰寫中 □無

專利：□已獲得 □申請中 ■無

技轉：□已技轉 □洽談中 ■無

其他：（以100字為限）

(Conference) Mei-Chun Wu (2015). 'Usability of smart phones: Influences of information structure and task complexity', International Symposium on Economics and Social Science, July 22-24, Tokyo, Japan.

(Conference) Mei-Chun Wu and Chao-Wei Huang (2015). 'Design of Diet Care App for Chronic Kidney Disease', International Symposium on Allied Health Sciences, Sep 5-6, Kelantan, Malaysia.

3. 請依學術成就、技術創新、社會影響等方面，評估研究成果之學術或應用價值（簡要敘述成果所代表之意義、價值、影響或進一步發展之可能性）（以500字為限）

由於行動技術快速發展，近年來行動商務大幅成長，使用行動裝置瀏覽網頁、購物乃現今使用者經常使用之功能。然而使用行動裝置進行購物時，受限於螢幕尺寸較小的限制，頁面呈現資訊量無法比擬網頁型購物網站。在此限制下，如何設計適當的資訊架構，讓使用者能順利、有效率地瀏覽及完成購物資訊收集，已成為行動裝置介面設計上的挑戰。本研究探討不同廣度、深度之資訊架構呈現方式對介面使用性的影響，並檢驗當使用者執行不同複雜度之任務時，資訊架構是否會影響使用者的任務績效表現。

本研究使用3 x 3二因子混合實驗設計，探討資訊架構、任務複雜度對使用智慧手機之瀏覽表現及操作滿意度的影響。資訊架構呈現方式分為：淺廣、中庸、深窄三種類型；任務複雜度分為：簡單、中等、困難三種不同難度之任務。本研究發現：

1. 越深的資訊架構，會增加使用者的迷失感與心智負荷。

2. 資訊架構設計，中庸型資訊架構之任務表現最佳，而主觀迷失感與心智負荷則以淺廣型資訊架構評價最好。
3. 任務複雜度與任務表現績效成反比，受資訊架構深度之調節。

研究結果顯示存在與資訊架構有關的認知處理，此外，增加資訊架構的深度會使得困難任務更難以執行。本研究成果可提供行動商務介面設計之依據。