Decisional Guidance for Computerised Personal Decision Aid (ComPDA)

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ABSTRACT

Recently, the existence of many computerized decision aids which support personal decision making have drawn massive attention to study how these aids really help the decision makers. Helping decision maker makes a particular decision has always been the major aim of decision aids. However, designing an effective decision aid is more than meet the eyes. Guidance portion of the interface design in decision aid cannot be taken lightly as it can influence the outcomes. This study acknowledges the needs to make sure the design of personal decision aids adhere to systematic investigation to achieve the sole goal of a ComPDA. In this paper eight ComPDAs were identified and comparedto extract the decisional guidance components for ComPDA. Accordingly, comparative analysis of the tools is further explained and illustrated.

Keywords: Decisional guidance, computerized personal decision aid

I INTRODUCTION

Decision aids come in many varieties. The aids can vary in complexity from simple checklists, to statistical models, even to complicated expert systems. Ideally, decision aid is designed with its major aim to assist human in choosing the best decision possible with the knowledge they have available. However, creating effective decision aids is not simply a matter of finding a method that produces the most accurate answer or the interface that best presents the result, but it is also of finding the most effective way to assimilate tools with human problem solving needs (Hayes &Akhavi, 2008). Thus, implying that designing such aid relies on comprehensive and systematic investigation of human decision behavior and also designs principles.

Lately, the existence of computerized decision aids which support personal decision making is mushrooming and progressively getting attention from users. The aids come in varying different mediums; website, software, spreadsheet, and mobile. In promoting the applications, appealing taglines were publicized, for instance like "…decision made easy", "...Territory of Clearness!","…the best decision analysis software package on the market", "…the easiest path to quality decisions", "Decision making confidence with…", and "…make complex decisions in easily".

Additionally, two instances of websites that offer personal decision making tool like "Hunch"[1] and "Let Simon Decide"[2] have reportedly drawn massive attention from the internet users in only the first year of their existence (Mashable.com, 2009a; 2009b). This shows that users (i.e. decision makers) do utilize and rely on this kind of application to help them in making decision. Also it shows that it is agreed by many that taking few minutes to clarify one's vision and goals when facing a decision that is not coming easily is plausible.

Consequently, the existence of these ComPDA provides evidence that a study to explore, how these aids really help the users as they are intended for, seems to be highly necessary. How decision makers interact with a system is also an important design issues. One issue, unique to the design of decision aids is the type and amount of guidance, called decisional guidance, that a decision support technology provides its users in the decision making process (Silver, 1991). Hence, shows that decisional guidance can reflect the effectiveness of the decision aid.

Helping decision maker makes a particular decision has always been the major aim of decision aids. However, designing an effective decision aid is more than meet the eyes (Power, 1998; Hayes &Akhavi, 2008). In general, decisional guidance encompasses overall interface concept to assist user in completing tasks by performing functions on the user side. Stressing on a good interface design of decision support technology is important in determining the outcome of the solution (Jiang & Klein, 2000). Moreover, having a good design system leads to a successful use among users (Turban, 1995). Hence, this study acknowledges the needs to make sure the design of personal

[1] www.hunch.com
[2] www.letsimondecide.com

decision aids adhere to systematic investigation to achieve the sole goal of a ComPDA.

II DECISIONAL GUIDANCE

One of the major concerns in the studies of decision support is the design issues. In order to help the users with their decision task, they must learn to adapt with the system either function wise or operation wise. Consequently, Gaines (1981) argues that a decision support technology should provide multi-level assistance to assist user to learn and utilize the application. Houghton (1983) provides a good example of a multi-level assistance; query-in-depth. The technique is illustrated in Figure 1.

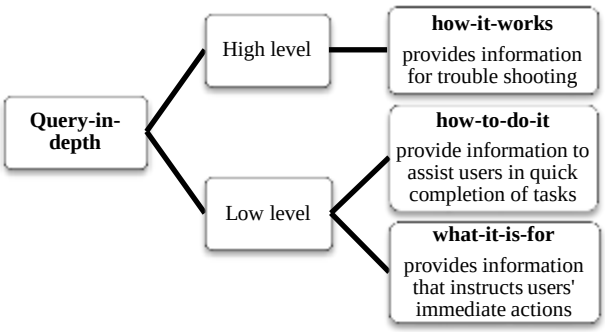

Figure 1. Multi-level assistance

However, this kind of interaction normally leads to extensive cycles of prototypes testing which is costly and time demanding. Within this perspective, Silver (1991) proposes decisional guidance as a solution to the problem. Jiang and Klein (2000) define decisional guidance as "*interface concept to assist a user in the completion of tasks by performing functions usually left to the discretion of the user*". Also, the authors classify decisional guidance as either predefined-informative or participative-suggestive. Table 1 briefly explains both categories.

Table 1.Decisional Guidance Categories

Categories	Features
1. Predefined-informative	• Provides certain information to the user and requests additional input to complete a defined task. • Provides pertinent information that assists the decision maker's judgment, without suggesting how to act.
2. Participative-suggestive	• Segments the defined task and provides guidance steps dependent upon the action previously taken by the user. • Facilitates users' on a more detailed level, perhaps even prompting for needed information.

According to Silver (1991), decision guidance refers to the manner in which a decision support technology leads users to structure and execute their decision making process. Silver classifies decisional guidance into four dimensions: (1) targets (structuring and execution), (2) forms (informative and suggestive), (3) modes (predefined, dynamic and participative), and (4) scopes (short and long ranged). This reflects a more inclusive classification of decisional guidance.

The style of interface designs has long evolved from the popular pull-down menus and help screens to interfaces that enable users to manipulate the underlying rules of the applications. In line with this, a number of researchers have begun to incorporate decisional guidance mechanisms in the design of decision support technologies (Carrol&McKendree, 1987; Black et al., 1989).

Furthermore, Silver (1991) emphasizes the advantages of decisional guidance, in which it may facilitate users to derive their own recommendations while enhancing their decision making skills. Similarly, results in Parkes' (2010) show that providing decisional guidancehelped novice decision makers produce higher quality recommendations; and that adoption of those recommendations improved decision quality.In addition, Montazemi et al. (1996) claimed that decisional guidance also helps to reduce the system restrictiveness while minimizing users' confusion.

Interestingly, decisional guidance mechanisms can also be seen as part of the evaluation criteria. This implication is supported by Rhee and Rao (2008), in which the authors argue that decisional guidance is actually derived from evaluation criteria. Hence, it makes decisional guidance mechanism as an important factor for the effectiveness of decision support technology.

Understanding the concepts of decisional guidance including the **predefined-informative** and **participative-suggestive** really implicates this study. In developing the conceptual design model of a computerized decision aid, the style of interface design plays important role in ensuring that the design model mapped with all the features that is necessary to cater for personal decision. As the roles of the two concepts are relatively dissimilar, in fact both have certain advantages towards implementation of it in decision aid, this study proposes that consideration of both concepts of decisional guidance are important. However, underlying principles of interface design by Schneiderman's (1992) are also used as guidelines with regards to matters concerning interface design of personal computerized decision aid.

III COMPUTERIZED PERSONAL DECISION AIDS

Computerized personal decision aid (ComPDA) is defined as decisional tool that assist in personal decision making. In this study, eight samples of ComPDA have been identified and studied as displayed in Table 2. Generally, selection of the ComPDA involved in this study was made based on a number of reasons. Nevertheless, the number of aids reviewed in this study is meant to be representative, not exhaustive.

- Samples incorporate decision theoretic approach to ensure the process is systematic and reliable.
- Samples provide assistance in personal decision making.
- Samples include varying modes of application (website, software and spreadsheet) to illustrate different design of computerized decision aid.
- Samples were selected from recent studies (1999 the oldest; 2009 the latest) to exemplify the design of current computerized decision aids.

Table 2. Features of ComPDA samples

ComPDA	Mediums	Modes of operation	Features
A1: Hunch (www.hunch.com)	Website	• Collective intelligence • Machine learning • Decision trees	• Uses machine learning based on statistical inferences. • Uses question-selection algorithm to find a question which can help optimize and rank the outcomes to present user with the most preferred one.
A2: Let Simon Decide (www.letsimondecide.com)	Website	• Collective intelligence • Weighted decision analysis	• Consists of 3 tools: *My Scores* (for logical, fact based decision with multi-alternatives), *My Life Match* (for big, life-changing decisions) and *My Points of View* (for quick decision). • Combines user qualitative input with a weighted, mathematical formula.
A3: Choose It!	Software	Decision Matrix	Supports business, financial, and personal life decisions.
A4: "Management For The Rest of Us" Decision Tool	Spreadshee t	Decision Grid	Tool contains overview of how to make decisions, decision making example, and decision template.
A5: Decision Oven	Software	Decision matrix	Supports personal and business decisions.
A6: DEXi	Software	Qualitative multi-attribute model	Incorporates qualitative multi-attribute models for the evaluation and analysis of options.
A7: Logical Decisions v6.1	Software	Multi-methods (simple rank ordering, tradeoffs & AHP)	It includes features from spreadsheet and database programs that let decision maker organize the information they have collected about the choices.
A8: Super Intuition	Spreadshee t	Decision table	It considers alternative list, decision table, facts, value rankings and value ratings.

The following subsection discusses the comparison made to the samples of ComPDA. Generic components of decisional guidance for such aid are obtained from the activity.

IV COMPONENTS OF DECISIONAL GUIDANCE

In seeking for the components of decisional guidance for ComPDA, comparative analysis method was employed. The analysis involves samples of existing ComPDAs as described earlier. The existing ComPDAs were assessed on the following aspects of decisional guidance. The proposed components of decisional guidance are guided by several works (see Turban, 1995; Jiang & Klein, 2000; Power, 2002) which linking them to decisional guidance in decision support system.

1. *Design elements (D)*:
    a. Graphics
        i. Graphs – representation of decision outcome in a form of numerical data plotted on axes, help to illustrate and compare data.
        ii. Charts – representation of decision outcome in a graphical format, help to illustrate and compare data.
        iii. Images – representation of outcome and/or explanations with pictures.
    b. Text – text such as titles, description, instructions and captions.
    c. Colors – a way to call attention to extreme or exceptional data values, help differentiate among items, convey information quickly.
    d. Icons/Symbols – small picture that represents a window/display which is currently not shown (closed).

e. Hypermedia – documents that could contain several types of media which allow information to be linked by association.
f. Hypertext – way to of handling text and graphic information by allowing users to jump from a given topic, whenever they wish, to related ideas.

2. *Styles of interaction (I)*:
   a. Menu interaction – allow user to select a task or function from a list of possible choices which can appear in logical or hierarchical order.
   b. Pull-down menus – a sub-menu that appears as a superimposed drop-down menu on the screen.
   c. Command language – the style that requires user to enter a command in a verb-noun combination or sometimes can also be a voice.
   d. Question and answers – a two way interaction between computer and users, were it begins with computer asking user a question and then user answer with a phrase or sentence (or by selecting an item from a menu). The user may prompt the user for clarification or additional input.
   e. Form interaction – the style that requires user to enter data or commands into designated spaces (fields) in forms.
   f. Natural language – a human computer interaction that is similar to a human-human dialog.
   g. Object manipulation – the style that usually represents objects as icons (or symbols) that are directly manipulated by the user.

3. *Styles of guidance (G)*:
   a. Predefined-informative – mechanisms that provide certain information to the user and requests additional input to complete a defined task.
   b. Participative-suggestive – mechanisms that help segment a defined task and provide guidance steps dependent upon the action previously taken by the user.

4. *Dialog/User interface guidelines (UI)*:
   a. Consistency – concerns with consistent sequence of actions in similar situations; identical terminology used in prompts, menus and help screens; and consistent commands.
   b. Shortcuts – the use of abbreviations, special keys, hidden commands and macro facilities to cater the needs for frequent users.
   c. Feedback – responses to every user action.
   d. Closure – concerns with the organization of sequences of actions, which involve beginning, middle and end. The informative feedback at the completion of a group of actions gives user the satisfaction of accomplishment, a sense of relief, signal to drop contingency plans and options from minds, and indication to prepare for next group of actions.
   e. Error recovery – if an error is made, the system should detect the error and offer simple, comprehensible mechanisms for handling it.
   f. Reversal of actions – allow user to undo previous action, which provide sense of relief and also encourages exploration of unfamiliar control.
   g. Internal control – give sense of in control to experienced users that the system responds to their actions accordingly.
   h. Information-load reduction – measure of the degree to which a person's memory is used to process information on a display screen.
   i. Multi-level assistance – help users learn and use the system, for example, 'query in depth' is a technique that provides multi-level assistance at various levels of expertise.

V COMPARATIVE ANALYSIS OF COMPDAS

Table 3 compares the findings from the comparative analysis made to the samples of ComPDAs based on the previous components. Accordingly, from the total of occurrence of each component in the samples, this study proposes a list of generic components in decisional guidance for ComPDA. The conditions for determining compulsory and recommended components are as displayed in Table 4.

Table 3. Decisional Guidance Components for ComPDA

	Components	A1	A2	A3	A4	A5	A6	A7	A8	T
D	Graphs							✓		1
	Charts		✓	✓	✓	✓	✓	✓	✓	7
	Images	✓	✓						✓	3
	Text	✓	✓	✓	✓	✓	✓	✓	✓	8
	Colors	✓	✓	✓	✓	✓	✓	✓	✓	8

	Icons/Symbols	✓	✓			✓	✓	✓	✓	6
	Hypermedia	✓	✓	✓					✓	4
	Hypertext	✓	✓	✓						3
I	Menu interaction		✓			✓	✓	✓		4
	Pull-down menus	✓					✓	✓		3
	Command language									0
	Question & answers	✓								1
	Form interaction	✓	✓	✓		✓	✓			5
	Natural language									0
	Object-manipulation				✓			✓	✓	3
G	Predefined-informative	✓	✓		✓				✓	4
	Participative-suggestive		✓	✓	✓	✓	✓	✓	✓	7
UI	Consistency	✓	✓	✓	✓	✓	✓	✓	✓	8
	Shortcuts	✓				✓	✓	✓		4
	Feedback	✓	✓	✓	✓	✓	✓	✓	✓	8
	Closure	✓	✓	✓		✓	✓	✓	✓	7
	Error recovery		✓		✓		✓	✓		4
	Reversal of actions	✓	✓	✓	✓	✓	✓	✓	✓	8
	Internal control	✓	✓	✓	✓	✓				5
	Info load reduction	✓	✓	✓	✓	✓	✓	✓		7
	Multi-level assistance	✓	✓		✓		✓	✓	✓	6

Note.
A1 = Aid 1 (Hunch.com)
T = Total
✓indicates the component is used in the aid

Table 4. Conditions for Classification of Generic Components

Conditions (Total score)	Indications
6 to 8	Compulsory
3 to 5	Recommended
0 to 2	Discarded

Based on the conditions stated in Table 4, the generic components of decisional guidance for ComPDA are proposed and as demonstrated in Table 5.

Table 5. Decisional Guidance Components for ComPDA

	Components	for ComPDA
D	Charts	Compulsory
	Images	Recommended
	Text	Compulsory
	Colors	Compulsory
	Icons/Symbols	Compulsory
	Hypermedia	Recommended
	Hypertext	Recommended
I	Menu interaction	Recommended ⌘
	Pull-down menus	Recommended ⌘
	Form interaction	Recommended ⌘
	Object-manipulation	Recommended ⌘
G	Predefined-informative	Recommended ⌘
	Participative-suggestive	Compulsory ⌘
UI	Consistency	Compulsory
	Shortcuts	Recommended
	Feedback	Compulsory
	Closure	Compulsory
	Error recovery	Recommended
	Reversal of actions	Compulsory
	Internal control	Recommended
	Info load reduction	Compulsory
	Multi-level assistance	Compulsory

Note.⌘= can be either one or combined.

From the proposed components in Table 5, the summary of decisional guidance for ComPDAis constructed as illustrated in Figure 2.

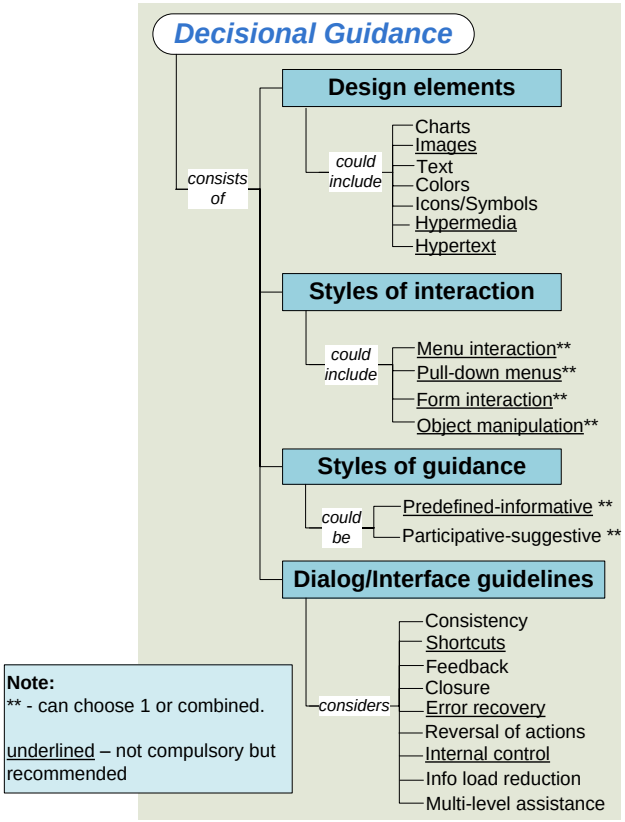

Figure 2. Summary of Decisional Guidance for ComPDA

VI DISCUSSION AND FUTURE WORKS

The outcome of this study must be viewed with caution with respect to generalizations. As aforementioned, the samples of ComPDAs used in this study are not exhaustive and were not classified into different medium of applications (i.e., online and offline applications). In fact, consideration of others might produce different summary of decisional guidance pertinent to ComPDA.

Other limitation - the outcome cannot be extended to various medium (e.g., mobile computing, cloud computing) of decision support technologies as each medium may have unique considerations. Thus, future studies need to include analysis based

on a set of mobility criteria for the decisional guidance of ComPDA. The same argument applies to decision aids in cloud computing environment.

In addition to that, further exploration of issues pertinent to decisional guidance in ComPDA could include the following; Does the decisional guidance affect how much time the decision maker spends using a system? Does increased ease of use translate into increased frequency of use? When do the costs of learning the guidance mechanisms exceed the benefits of using them? These and other questions should be addressed to assist in the development of future ComPDA.

VII CONCLUSION

Recent decision support studies focused on important characteristics and design issues (Jiang & Klein, 2000; Hayes &Akhavi, 2008). This stream of research found that when decision assistance matches the users' mental models, the more easily and quickly users learn the system. Decisional guidance encompasses overall interface concept to assist user in completing tasks by performing functions on the user side. Stressing on a good interface design of decision aid is crucial in determining the outcome of the solution (Jiang & Klein, 2000). In line with this, this study outlines the design approach to providing decisional guidance in ComPDA. Four main components are included in the decisional guidance model for ComPDA, namely *design elements*, *styles of interaction*, *styles of guidance* and *dialog/user interface guidelines*. In design elements, charts, images, text, colors, icons/symbols, hypermedia and hypertext could be included. In styles of interaction, menu interaction, pull-down menus, form interaction and object manipulation could be opted. In styles of guidance, there are two main types which are predefined-informative guidance and participative-suggestive guidance. In terms of dialog/user interface guidelines, consistency, shortcuts, feedback, closure, error recovery, reversal of actions, internal control, information load reduction and multi-level assistance could be considered.

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