A Comparison of a Traditional Ranking-Task and a
Drag-and-Drop Ranking Task

Thesis

Submitted to

The College of Arts and Sciences of the

UNIVERSITY OF DAYTON

In Partial Fulfillment of the Requirements for

The Degree

Master of Arts in Psychology

By

Stephen Thomas Karth

UNIVERSITY OF DAYTON

Dayton, OH

May, 2011
A COMPARISON OF A TRADITIONAL RANKING-TASK AND
A DRAG-AND-DROP RANKING RASK

Name: Karth, Stephen Thomas

Approved By:

____________________________
William F. Moroney, Ph.D.
Chairperson, Thesis Committee

____________________________
Saverio Perugini, Ph.D.
Thesis Committee Member

____________________________
Susan T. Davis, Ph.D.
Thesis Committee Member

Concurrence:

____________________________
Carolyn E. Roecker Phelps, Ph.D.
Chair, Department of Psychology
Abstract

A Comparison of a Traditional Ranking-Task and a Drag-and-Drop Ranking Task

Name: Stephen Thomas Karth
University of Dayton

Advisor: W. F. Moroney, Ph.D

Differences between a modified traditional ranking-task format (MTF) and an experimental Drag-and-Drop Assisted Ranking-Task (DDART) were investigated. Completion time for each format was determined, as was format preference, the relationship between the data of the two formats, and participant strategies for completing the tasks. Participants completed: both ranking-tasks in a counterbalanced administration, a battery of demographic and preference questions, a System Usability Scale (SUS) questionnaire for both formats to measure usability, and a ratings questionnaire. They also developed sequences describing their decision-making during the ranking process.

There was no significant difference in completion time. However, a non-significant lower average completion time for DDART suggested that, with further exposure, participants would continue to decrease completion time faster than they would using the MTF. Participants also believed that they completed DDART faster. The results of the SUS indicated DDART was not significantly more or less usable than the MTF. However, when asked to compare the “ease of use” of the two formats,
participants preferred using DDART to MTF by a margin of 2 to 1. A significant relationship existed between the ranking data obtained from both formats. The ranking data for both MTF and DDART were also significantly correlated with data garnered under the ratings format. By examining the participants’ descriptions of their decision-making process, the experimenter identified four strategies participants could have used in completing either of the two formats. Task format did not influence the frequency of selection of a participant’s strategy. The more popular strategies (Level Driven and Numeric Rank Driven) were characterized by participants initially selecting a ranking (first, ninth, etc.), and then assigning an option to that ranking. Fewer participants initially selected an option and subsequently assigned a rank to that option (Similar Option Driven and Individual Option Driven).

Overall, DDART was functionally comparable to MTF because there were no significant differences in completion time, the frequency of use of the strategies was similar, and the relationship between the ranking data for each format was strong. Statistically, more participants preferred DDART to MTF and believed it was easier to use and faster to complete.
Acknowledgements

I owe a debt of gratitude to my advisor, Dr. William F. Moroney, for providing the time, resources, and patience necessary to complete this thesis. I also give a special thank you to Dr. Saverio Perugini for developing and creating the software that was studied in this project. I also thank Dr. Susan T. Davis for serving as a member of my advisory committee.
# Table of Contents

Abstract ................................................................................................................................. iii

Acknowledgements ............................................................................................................. v

List of Figures ...................................................................................................................... ix

List of Tables ....................................................................................................................... x

I. Introduction ....................................................................................................................... 1

   Ranking - Task Formats ................................................................................................. 1
   The Number Assignment Format ................................................................................. 2
   The Line Drawing Format ............................................................................................. 2
   The Point Allocation Format ......................................................................................... 4

   Respondent Burdens ..................................................................................................... 5
   Working Memory Capacity ............................................................................................ 5
   Scan Time ....................................................................................................................... 6
   Completion of Review Process ....................................................................................... 7

   Other Techniques Yielding Ranking ............................................................................. 7
   Rating Scales .................................................................................................................. 7
   Paired Comparisons ...................................................................................................... 8
   “Top Three, Bottom Three” ........................................................................................ 9
   Card-Sorting ..................................................................................................................... 9

   Modified Traditional Format ......................................................................................... 11

   Research Expectations ................................................................................................. 12

II. Method ........................................................................................................................... 15

   Participants ..................................................................................................................... 15
   Materials and Apparatus ............................................................................................... 15
   Procedure ....................................................................................................................... 17
   Metrics ............................................................................................................................ 20
   Analysis .......................................................................................................................... 21
III. Results .......................................................................................................................... 24

Completion Time ............................................................................................................ 25
Format Preference ......................................................................................................... 26
Usability .......................................................................................................................... 26
Repositioned Rankings ................................................................................................. 27
Ranking Relationships ................................................................................................. 28
Decision-Making Sequences ....................................................................................... 31

IV. Discussion .................................................................................................................. 33

Recorded/Perceived Completion Time ......................................................................... 33
Format Preference ......................................................................................................... 34
Usability .......................................................................................................................... 35
Repositioned Rankings ................................................................................................. 35
Ranking Relationships ................................................................................................. 36
Ranking Strategies ......................................................................................................... 37
Considerations for Future Studies .............................................................................. 38
Conclusion ...................................................................................................................... 39

References ...................................................................................................................... 41

Appendices

A. Informed Consent to Participate as a Research Subject ............................................. 43
B. UD Admissions Questions, Part 1 ............................................................................. 45
C. DDART Practice Task ............................................................................................... 49
D. MTF Practice Task .................................................................................................... 50
E. DDART Trial ............................................................................................................... 51
F. MTF Trial .................................................................................................................... 52
G. UD Admissions Questions, Part 2 ............................................................................ 53
H. Procedures Questionnaire ......................................................................................... 56
I. Format Preference Questionnaire .............................................................................. 63
J. Modified System Usability Scale (SUS) ..................................................................... 65
K. System Usability Scale (SUS) Scoring Instructions .................................................. 69
<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>L. Ratings Questionnaire</td>
<td>70</td>
</tr>
<tr>
<td>M. Debriefing Form</td>
<td>74</td>
</tr>
</tbody>
</table>
List of Figures

1. Illustration of Three Typical Ranking – Task Formats ........................................3
2. Illustration of a Partially-Completed Likert – Style Rating Scale with Instructions …..8
3. Illustration of Partially-Completed Paired Comparisons with Instructions ..............9
4. Illustration of a “Top Three, Bottom Three” Task with Instructions .....................10
5. Illustration of a Partially Completed Card-Sorting Task with Instructions ..............11
6. Illustration of a Partially-Completed MTF Task with Instructions .......................12
7. Illustration of a Partially-Completed DDART Task with Instructions ...................16
8. Participant Protocol .................................................................................................19
9. Frequencies of use of Ranking Strategies ................................................................31
List of Tables

1. Metrics and Methods of Measurement .................................................................21
2. Ranking Task Completion Times, Means, and Standard Deviations in Seconds ........25
3. Number and Percent of Respondents Preferring MTF or DDART ..........................26
4. Mean Usability Scores for MTF and DDART Formats ........................................27
5. Mean Number of Repositioned Rankings .............................................................27
7. Correlations and Significance of Correlations Between MTF and DDART Rankings for Each Aspect .................................................................29
8. Correlations and Significance of Correlations of MTF and DDART Rankings for Each Aspect .................................................................30
Chapter I

Introduction

Ranking requires respondents to order a list of options based on a specified criterion. Ranking-tasks are used to order opinions, priorities and attitudes. For example, if an interface designer needed to identify the most preferred of four interfaces, test participants could evaluate each interface and then rank order the interfaces from most to least preferred. Because of the high cognitive load (Streiner & Norman, 2003; Dillman, 2009) associated with ranking, including the limited capacity of human working memory, the visual scan time associated with surveying the list of options, and the difficulty of assigning a ranking to the options when multiple are present, survey designers are reticent to include ranking-tasks in surveys. In an effort to reduce the cognitive load, a new ranking-task format was developed and is examined in this thesis. The experimenter expected that participants would: a) complete the ranking process faster with the new ranking-task format and b) prefer the new experimental format to the traditional format.

Ranking-Task Formats

Three commonly used ranking-task formats are the number assignment format, the line-drawing format, and the point allocation format. The advantages and disadvantages of each format are described below and illustrated in Figure 1.
The Number Assignment Format. The most common format (Figure 1a), presents options in a vertical list and acts as the baseline format for this thesis. Respondents rank the options by writing the desired rank on the line in front of the option. Although, most respondents have experience with this format, there are burdens, most notably when an individual needs to alter a response by erasing a rank and re-ranking the option.

In this case, prior responses are also affected because the rankings are mutually exclusive. For example, if the respondent decides that the option ranked sixth needs to be ranked second, all of the responses between the second and sixth rank are displaced and need to be repositioned. The burden imposed by the re-ranking process can lead respondents to avoid the re-ranking process even though the rankings may not reflect respondents’ true attitudes.

When implemented using the paper and pencil medium, there is no automated process to verify if the respondent has properly completed the ordering. A scoring dilemma can arise if the experimenter discovers that a respondent either did not assign a rank and/or used the same rank twice. However, this dilemma can be avoided by implementing an electronic version of the number assignment format because an automated check can ensure the proper completion of the task.

The Line Drawing Format. This method, (Figure 1b) contains two columns. The left-hand column is a list of options to be ranked. The right-hand column is a vertical array of ranks arranged in increasing numerical order. To complete this format, the respondent draws lines from the options to his or her desired ranking position. This
format has no demonstrated advantages over the number assignment format, although is most likely faster since the list of ranks is provided.

1a. Number assignment format with instructions
Please rank each cookie type in order of preference. Place a 1 in front of your most preferred, a 2 in front of your second most preferred, and so forth.

____ Chocolate Chip
____ Oatmeal Raisin
2 __ Sugar
1 __ Ginger
____ Peanut Butter

1b. Line drawing format with instructions
Please rank each cookie type in order of preference. Draw a line from your most preferred cookie type to 1, your second most preferred to 2, and so forth.

[Diagram showing ranking: Chocolate Chip 1, Oatmeal Raisin 2, Sugar 3, Ginger 4, Peanut Butter 5]

1c. Point allocation format with instructions
Please distribute 100 points among these cookie types based on your preference for each of them.

25 __ Chocolate Chip
10 __ Oatmeal Raisin
15 __ Sugar
40 __ Ginger
10 __ Peanut Butter

Figure 1. Illustration of Three Typical Ranking-Task Formats.
Similar to the number assignment format, this format has a high respondent burden when an individual wishes to alter a response. If a respondent encounters this situation, he or she must erase/delete the line, and redraw it. Since shifting one rank frequently alters another, this process may need to be repeated several times before the respondent is content with his or her responses. When implemented using paper and pencil, this process creates problems for both the respondent and the experimenter. The respondent may become frustrated by having to make changes and may abandon the process. Conversely, if multiple changes are made, smudges and eraser marks can make response interpretation difficult for the experimenter.

The Point Allocation Format. A less traditional ranking-task format (Figure 1c) is described by Duffy and Weber (1974). Similar to the number assignment format, a column of options is listed with a fill-in-the-blank box next to each option. Instead of assigning a specific rank to the options, respondents begin the task possessing a point value (e.g. 100) to distribute among the options. The point value assigned to an option is proportional to point values assigned to the other options. Thus, if the first option is assigned five points and the second option is assigned ten points, the first option is valued at half of the second option. After all of the point values have been assigned, options can then be ordered based on their respective values. Since point value assignments are proportional to each other, the relative positions of the options can be determined. Unless specified by the experimenter, a respondent can allocate the same point value to two different options. This format places a high cognitive load on respondents because they must assign all points.
Respondents face an additional burden when determining if they have properly completed this format. When using the two previous formats, respondents determine completion by a visual inspection. However, with the point allocation format, a calculation is needed to ascertain that all points have been assigned, and to ensure completeness the experimenter must also perform this calculation.

Similar to the previously discussed formats, this format also presents an obstacle when respondents desire to reallocate points. Changing one response leads to the alteration of other responses, and respondents can become quickly overwhelmed if they have a large number of points to reallocate.

**Respondent Burdens**

Because of the high cognitive load associated with ranking, respondents face many burdens when completing ranking-tasks. The most common burdens are associated with human working memory capacity, the time required for multiple scans of the options list, and the difficulty of determining assignment of desired values. These items are considered below.

**Working Memory Capacity.** The limitations of working memory are a factor when a ranking-task is completed via the telephone (Dillman, 2009; Fowler, 1995) because the number of options spoken to the respondent can exceed working memory capacity. As described in Miller (1956), the general population has a working memory capacity of seven plus or minus two items. If a respondent cannot remember the options, they will not be able to compare the options, make choices, and assign ranks. Remembering the options while conversing with a survey administrator is a highly demanding cognitive task. Therefore, Sudman and Bradburn (1982) recommend that
ranking-tasks be presented in a medium in which a respondent can review all alternatives, simultaneously.

**Scan Time.** When a respondent begins a ranking-task, he or she must familiarize him or herself with the options to be ranked by visually scanning them. This process is repeated as options are removed from the source list and placed in the ordered list. Thus, “19 passes will need to be made at a 20 item list” (Alreck & Settle, 2004), since the respondent must re-scan the list each time a rank is assigned. This is notable because 19 is the minimum number of scans needed, and the actual number of scans executed is potentially far greater, resulting in an extremely lengthy and tedious process. When options are ranked, the physical list of options remains unchanged. In an effort to be efficient, respondents may resort to “crossing-out” options that have already been ranked. This practice may reduce the respondents’ cognitive load because the “crossing-out” procedure provides a cue that the eliminated option can be ignored; however, the respondent still must scan through the entire list, and the “cross-outs,” which are still similar in appearance, can still be difficult to discriminate from the unranked options (Aglioti, 1997), which can increase scan time and retard the ranking process.

When designing a ranking task, the importance of considering both scan time and working memory capacity when choosing the number of options is critical. Therefore, it is recommended that ranking-tasks contain no more than 10 options (Alreck & Settle, 2004) as respondent burden increases with the number of options (Dillman, 2009). Failure to consider these concepts in questionnaire design leads to cognitive fatigue for respondents, and they may become careless when responding (Parten, 1950). If
respondents are ambivalent about the ranking process, the data obtained may be invalid (Streiner & Norman, 2003).

**Completion of Review Process.** This burden concerns the respondent’s responsibility for determining when the desired order for the ranking assignments has been achieved. Since an ordered list of the final rankings (i.e. 1, 2, 3, 4…) is not traditionally presented to respondents, it is difficult for them to verify that they have appropriately assigned their desired values. Because of this, respondents may abandon or skip the review process entirely and, emphasizing expediency, submit their initial responses.

**Other Techniques Yielding Ranking**

Since ranking-tasks are somewhat problematic, several existing alternative techniques have evolved to yield ordered data. These alternatives include, but are not limited to: rating scales; paired comparisons; “Top Three, Bottom Three;” and card-sorting.

**Rating Scales.** This technique (Alreck & Settle, 2004; Fowler, 1995; Moroney & Cameron, 2006) asks respondents to rate a single option based on a specific criterion, and can be implemented using a Likert-style scale (Figure 2). Ratings are advantageous because they provide a measurement of distance between the options, and are significantly correlated with rankings, so similar data can be obtained, without imposing the aforementioned burdens (Alwin & Krosnick, 1985).

When rating options, respondents only scan the options once and then assign a value to them, instead of having to compare the options to those remaining. However, a single rating does not provide any comparative data. For example, if an experimenter
asks a respondent to rate six items on a five-point scale, it is possible that two or more items will be assigned the same rating, which precludes any comparison. As shown in Figure 2, a neutral rating has been assigned to both the chocolate chip and sugar cookie types.

Please pick a number from the scale to show how much you prefer or do not prefer the following cookie types.

Scale
1 – Strongly prefer
2 – Prefer
3 – Neutral
4 – Do not prefer
5 – Strongly do not prefer

__ 3 ___ Chocolate Chip
_ 1 ___ Oatmeal Raisin
__ 3 ___ Sugar
____ Ginger
_____ Peanut Butter

Figure 2. Illustration of a Partially-Completed Likert-Style Rating Scale with Instructions.

**Paired comparisons.** This method (Oppenheim, 1966; Sudman & Bradburn, 1982) is another alternative to ranking-tasks. This technique is essentially a ranking-task between two options. While this format, shown in Figure 3, provides both comparative and scaled data, it becomes a time consuming and rigorous process for both the respondent as well as the experimenter. If an experimenter wishes to compare 20 options, using the formula: $\frac{1}{2}N(N-1)$, the respondent would have to complete 190 individual paired comparisons (Oppenheim, 1966). Clearly, this alternative has a high respondent burden.
For each pair of cookie types listed below, please put a check mark by the cookie type you most prefer, if you had to choose between the two.

(1) ☑ Chocolate Chip
(2) ______ Oatmeal Raisin

(1) ______ Sugar
(2) ☑ Chocolate Chip

(1) ______ Oatmeal Raisin
(2) ______ Sugar

Figure 3. Illustration of Partially-Completed Paired Comparisons with Instructions.

“Top Three, Bottom Three”. This method (see Figure 4), another alternative for ranking-tasks (Sudman & Bradburn, 1982), is a modified version in which respondents rank only their top and bottom three choices and don’t assign a rank to the other options. While this format drastically reduces the cognitive load of the respondent (depending on the number of options in the overall set), it also does not provide any quantitative information about the options between the top three and bottom three options.

Card-Sorting. When completing the card-sorting method (Parten, 1950) (see Figure 5), a respondent is given a set of cards, each inscribed with one option. Respondents rank the options by arranging the cards in a column-like fashion. The option at the top of the column would have the rank of one; the next option would have a rank of two, etc.
Please read the entire list, and then rank your top 3 and bottom 3 cookie types in order of preference. Place a 1 by your most preferred, a 2 by your second most preferred, and a 3 by your third most preferred. Also, place a 10 by your least preferred, a 9 by your second least preferred, and an 8 by your third least preferred. Keep in mind that you will only be ranking a total of 6 cookie types.

1. Chocolate Chip
2. Oatmeal Raisin
3. Sugar
4. Ginger
5. Peanut Butter
6. Snicker-Doodle
7. Butterscotch
8. White Chocolate Chip
9. Macadamia Nut
10. Toffee Chip

*Figure 4.* Illustration of a “Top Three, Bottom Three” Task with Instructions.

While not utilized as commonly as other ranking-tasks, card-sorting has several advantages. First, altering a response becomes easier because no erasing is needed. Similarly, crossing out ranked options is no longer problematic because ranked options become responses. This format also allows respondents to view their rankings in sequential rank order, which facilitates their review of their responses. While having many advantages, this format is not practical in situations where a large number of people need to complete a ranking-task and/or where there are a large number of options.

Material cost and preparation make this format very cumbersome, unless only a small number of participants is required. The card-sorting format is also problematic for experimenters as the results must either be immediately recorded, or the cards must be
carefully collected to ensure the integrity of the data. Though the card-sorting technique is somewhat impractical, the concept remains important because it is the most analogous ranking format to the experimental format examined in this thesis.

Please rank the following 10 cookie types in the order of your preference for them. To do this, arrange the following cards in a vertical fashion. The card at the top of the column will represent your most preferred cookie type and the card at the bottom of the column will represent your least favorite.

Figure 5. Illustration of a Partially-Completed Card-Sorting Task with Instructions.

**Modified Traditional Format**

To evaluate the new ranking-task format presented in this thesis, an electronic version of the number-assignment format was developed. This Modified Traditional Format (MTF), shown in Figure 6, is analogous to the Number Assignment Format...
(Figure 1a). However, unlike in the paper and pencil medium, the MTF has two improved computer-based features.

Before we move on to the next question, I would like to familiarize you with our ranking procedure, by using the following example. I ask that you rank five different types of cookies from your most favorite to your least favorite. There are 5 cookie types in total to rank. Place a 1 in front of the type of cookie that you like the most, a 2 in front of your second choice and so on until all cookie types have been ranked. Each number (1-5) can only be used once, which means two types of cookies cannot have the same rank. When you have ranked all of the types of cookies, please click the submit button.

2   Chocolate Chip
1   Sugar
3   Peanut Butter
Oatmeal Raisin
Ginger

Figure 6. Illustration of a Partially-Completed MTF Task with Instructions.

First, an error message appears if a respondent attempts to submit responses and has not assigned a rank to each option. Second, a similar error message appears if the respondent assigns an invalid rank or assigns the same rank twice.

**Research Expectations**

The problems unique to ranking-tasks lead to the development of a new ranking-task format utilizing web-based drag-and-drop technology. This new format, known as DDART (Drag & Drop Assisted Ranking-Task) is described in Chapter 2, and combines aspects of existing ranking formats with attributes that cannot be implemented with traditional paper and pencil ranking-task formats.
The following predictions are based on the advantages which the investigator expects will be provided by DDART:

- Participants will successfully complete a ranking-task using DDART in less time than that required to complete the same task using MTF. This is expected because when using DDART, participants will need to store fewer items in working memory and spend less time retrieving and storing information from the options list. Participants will also be presented with an ordered list of the final rankings, which will further reduce the time required for reviewing responses for completeness and accuracy.

- Participants will prefer DDART to MTF. The experimenter believes that DDART’s drag-and-drop attributes will be more preferred than the attributes of the traditional method.

- Participants will describe DDART as more usable than MTF. This is expected because the experimenter believes that DDART is a more intuitive and, generally, a more efficient approach to ranking-tasks. This is also expected because all participants in this study will have had considerable experience using Microsoft Windows, a graphical user interface operating system that relies heavily on drag-and-drop technology. The System Usability Scale (SUS) was used to determine usability.

- Participants will reposition more rankings for the DDART trials than for the MTF trials. This is expected because repositioning a ranking is much
less troublesome and time consuming when using DDART than when using MTF.

- Rating data will be positively correlated to ranking data for both DDART and MTF trials. This is expected based on the significant correlations between ranking and rating data reported by Alwin and Krosnick (1985).
Chapter II

Method

Participants

Participants were 50 first-year (thirty two males; eighteen females) undergraduate students from the University of Dayton. All participants were experienced Windows users and had been using a university required Windows based PC for at least 6 months, and more than likely had experience with a graphical user interface (GUI) in high school. By choosing to participate in this study (among other possible studies) students fulfilled a course requirement for their introductory psychology course. Participants were tested in a computer lab using desktop computers with 19” LCD monitors, the Windows XP operating system, and the Mozilla Firefox web browser version 1.5. Testing stations faced the walls of the lab, and participants were seated with one station between each of them. Group sizes for testing ranged from 1 to 4 students.

Materials and Apparatus

As described in Chapter I, MTF was compared to the newly developed Drag-and-Drop Assisted Ranking-task (DDART) format. This new format (see Figure 7) consists of two adjacent columns: the options column and the response column. Options to be ranked populated the options column in a list format, and each option was enclosed within a cell, which demarcated a visual boundary. The response column was similar to
the options column, but was populated with a column of empty cells, each with a number (1 through X, X being the total number of options) to the left of it. To assign a rank, the participant selected an option with the computer mouse and dragged the option to the cell directly to the right of the desired rank and dropped it. When the option was moved to the response column, a grayed-out, text-free cell, from which the option was removed, remained in the options column.

Figure 7. Illustration of a Partially-Completed DDART Task with Instructions.

After a respondent had ranked every option, he/she could re-order the list in the response column as desired. This was accomplished by using the drag-and-drop process; however, the respondent dragged the options vertically as opposed to horizontally. When the selected option was dropped, other responses shifted up or down accordingly, so the
respondent did not have to reposition the other affected responses, as he/she would have to do when using the MTF. The respondent may have re-ordered the options as often as desired until the list reflected his or her opinion. After completing any reordering, the respondent clicked the “Submit” button to submit his or her responses. If all the options were not ranked, an error message instructing the respondent to rank all of the options was displayed.

**Procedure**

Once seated and given identification numbers, all participants read the informed consent form (see Appendix A), which provided an overview of the experiment. At this juncture, participants could have terminated their participation, but none did. The participants were then told to follow the onscreen instructions at their respective computer terminals. A representation of the procedural flow is provided in Figure 8.

Participants completed a battery of questions and ranking-tasks that were presented on six separate webpages. When finished with each webpage, the participant would click the “Submit” button located at the bottom of the respective webpage. While six separate webpages were used, the task appeared to be continuous to the participants.

The first webpage entitled, “UD Admission Questions, Part 1” (see Appendix B), was the same for all participants, and consisted of questions concerning the college enrollment process. This area of study was selected because of the recency of a college enrollment experience of the available pool (first-year college students). This first series of questions, as well as the latter series on a subsequent webpage entitled, “UD Admission Questions, Part 2”, served as distraction questionnaires, which were embedded between DDART and MTF administrations. Participants completed their first
of four ranking-tasks on the second webpage. Half of the participants completed a DDART practice task (see Appendix C) and the other half completed an MTF practice task (see Figure 8 and Appendix D). These practice tasks ensured that each participant understood how to use both formats before completing the respective trials.

After the experimenter verified that the participants had successfully completed the practice task, participants completed a trial of either DDART (see Appendix E) or MTF (see Appendix F). The options to be ranked for the trials consisted of 16 “aspects” (including: available majors, cost, extracurricular activities) of the University of Dayton that a prospective student may have considered when choosing the institution. To avoid confounding, the only difference between the practice tasks and the trials was the number and nature of the options.

Similar to its previously implemented counterpart, the questions contained in “Admission Questions, Part 2” (see Appendix G) concerned the participants’ college enrollment experience. Participants then completed the final practice task and final trial. If the participant received the MTF tasks previously, he or she received the DDART tasks for this portion.

At the conclusion of the computer-based portion of the experiment, participants completed four more paper and pencil questionnaires. The additional questionnaires were:

1. Procedures questionnaire (see Appendix H). This questionnaire requested participants to construct a decision-making sequence detailing the steps they executed in completing each ranking format. This information was used to determine the different strategies used by participants to complete the ranking-task formats.
Figure 8. Participant Protocol.
2. Format preference questionnaire (see Appendix I). This questionnaire garnered information concerning participants’ opinions about DDART and MTF.

3. System Usability Scale (SUS); (see Appendices J & K, Brooke; 1996). Participants completed a modified version of the original SUS, a commonly used method to evaluate usability. So as not to change the functionality of the scale, the only major modification was changing the word “system” in the original questionnaire to the name of the ranking-task format in question. Minor changes were made to ensure proper grammar.

4. Ratings questionnaire (see Appendix L). As mentioned previously, ratings scales are a commonly used alternative to ranking-tasks, and the data between the two have a high positive correlation. The data from this questionnaire (a six point Likert scale) were used to determine if participants were consistent in their responses across questionnaire structures.

   Upon completion of the ratings questionnaire, participants were debriefed (see Appendix M) and thanked for their time.

**Metrics**

The metrics listed in Table 1 were used to determine differences in participant responses and reactions to the ranking-task formats. Ranking-task completion time was recorded by the computer’s internal clock, which began timing when the webpage had loaded and ended when the participant clicked the submit button. By listing the step-by-step process that they used to rank the options, participants created decision-making sequences. The experimenter then analyzed these sequences for commonalities. Format preference was determined by the format preference questionnaire. The SUS was modified to fit the experiment and administered to determine the usability of both
formats. The ratings of the aspects were obtained using the ratings questionnaire. An internal tool imbedded within the code of the DDART ranking-task tracked the respondents’ positionings of the options and recorded the number of repositioned rankings.

*Table 1: Metrics and Methods of Measurement*

<table>
<thead>
<tr>
<th>Metric</th>
<th>Measurement Method</th>
</tr>
</thead>
<tbody>
<tr>
<td>Completion time</td>
<td>Time elapsed from the loading of the ranking-task webpage to when the participants clicked the submit button.</td>
</tr>
<tr>
<td>Preference</td>
<td>The participant’s preference for either of the two rankings task formats.</td>
</tr>
<tr>
<td>Usability</td>
<td>System Usability Scale (SUS) score (see Appendices J &amp; K)</td>
</tr>
<tr>
<td>Ratings</td>
<td>The rating of an aspect assigned by the participant.</td>
</tr>
<tr>
<td>Number of repositioned rankings</td>
<td>The number of initial rankings that a participant repositioned before completing the task.</td>
</tr>
<tr>
<td>Decision-making sequence</td>
<td>Sequences completed by participants describing how they completed each ranking-task.</td>
</tr>
</tbody>
</table>

**Analysis**

A multivariate repeated measures analysis of variance (MANOVA) was used to determine if there were any significant differences in completion time and usability between the two ranking-task formats. Post-hoc one-way ANOVAs were performed to examine interaction between the respective formats.

Two chi-square tests were used to determine any significant differences in preferences between formats. The first analysis compared the preferences between MTF,
DDART, or no format preference, and the second analysis compared the results of a forced preference between the MTF and DDART.

A Pearson product-moment correlation analysis was used to examine the relationship between the ratings of the options and their final rankings. The same statistic was also computed to analyze the relationship between each of the two ranking-task formats.

To analyze the decision-making sequences, the experimenter identified four possible strategies used by participants to complete the ranking process. These strategies were identified by the experimenter reviewing each of the decision-making sequences several times, and identifying commonly used techniques between them. After the review process, the sequences were sorted into four mutually exclusive bins, which were then entitled as ranking strategies based upon their commonalities. The resultant taxonomy follows:

1. Chunking Strategies
   a. Level Driven Strategy - While or after reviewing all options, participants sort each option into a major category such as highly preferable (top choices), not preferable (bottom choices), and neither highly preferable nor not preferable (remaining choices). They then order the options within each category. Examples of this strategy include:
      i. The participant ranks the top 3-5 options, then the bottom 3-5 options, and then orders the remaining options in the middle of the scale.
ii. The participant sorts the options as preferred or not preferred (a dichotomous procedure), then ranks all of the preferred options higher than the not preferred options.

b. Similar Option Driven Strategy - Participants sort each option into a major category based on similarities between the options. Major categories are then ordered based on preference, and the options within each category are ordered. Examples of this strategy would entail creating major categories, such as financial, academic, or extra-curricular considerations, etc. and then after prioritizing the categories, they order the options within each category.

2. Non-Chunking Strategies

a. Numeric Rank Driven Strategy - Participants rank options in a serial method starting at one end of the ranking scale (high or low) and progressing in the opposite direction. An example of this would be reviewing the options to determine which one has a ranking of “1,” then reviewing the remaining options to determine which option has a ranking of “2,” and so on, until all options have been ranked.

b. Individual Option Driven Strategy - Participants evaluate an option and assign a rank based on their estimation of where it should be ranked. They repeat this process with each subsequent option.
Chapter III

Results

The dependent variables of interest were: completion time, format preference, usability as scored by SUS, and the number of repositioned rankings per format. Comparisons were also made between rankings obtained under the MTF and DDART formats, and between ratings of each of the 16 aspects. Each of the decision-making sequences was classified as one of four response strategies: Level Driven, Similar Option Driven, Numeric Rank Driven, and Individual Option Driven. Data for each of the dependent variables are presented in this chapter.

Recorded data from 4 participants were eliminated from the study; however, the reported data from post ranking-task questionnaires were not eliminated because these data were not affected by any of the following problems. Due to a computer error, the completion time data for 1 participant were not recorded. Also, the recorded repositioned ranking data for 3 other participants were composed of outliers, which were greater than 2 standard deviations from the mean, suggesting a data collection error. Most participants reported repositioning their rankings between 0-10 times. The 3 eliminated participants had reported repositionings greater than 30.
**Completion Time**

Table 2 contains the means and standard deviations of the participants’
completion times under each ranking format as a function of presentation order in an
AB/BA design. A repeated measures 2 x 2 MANOVA yielded no significant main
effects, but did yield a significant interaction of completion time as a function of format
and presentation order, \( F (1, 44) = 4.68, MSE = 1225.72, p = .036, \eta^2 = .096 \). However,
two subsequent post-hoc one-way ANOVAs did not reveal a significant difference in

*Table 2: Ranking-Task Completion Times, Means, and Standard Deviations in Seconds*

<table>
<thead>
<tr>
<th>Presentation Order</th>
<th>Ranking Format</th>
<th>MTF</th>
<th>DDART</th>
<th>Grand Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>125.36 (44.48)</td>
<td>125.45 (33.98)</td>
<td>125.41 (39.37)</td>
</tr>
<tr>
<td></td>
<td>( n = 24 )</td>
<td>( n = 22 )</td>
<td>( N = 46 )</td>
<td></td>
</tr>
<tr>
<td>First</td>
<td>Second</td>
<td>114.21 (36.07)</td>
<td>104.97 (38.41)</td>
<td>109.39 (37.19)</td>
</tr>
<tr>
<td></td>
<td>( n = 22 )</td>
<td>( n = 24 )</td>
<td>( N = 46 )</td>
<td></td>
</tr>
<tr>
<td>Grand Mean</td>
<td></td>
<td>120.04 (40.62)</td>
<td>114.77 (37.42)</td>
<td>117.40 (38.92)</td>
</tr>
<tr>
<td>( N = 46 )</td>
<td></td>
<td>( N = 46 )</td>
<td>( N = 46 )</td>
<td></td>
</tr>
</tbody>
</table>

*Note.* Standard deviations in parentheses.

completion times for MTF, \( F (1, 44) = .862, p = .358 \), or DDART, \( F (1, 44) = 3.641, p = .063 \),
as functions of presentation order. Since there was no significant difference in
completion time across all four groups (Presentation Order by Format), presentation order
was collapsed in the subsequent analyses.
Format Preference

When choosing format preference, participants could select the option of MTF, DDART, or neither; however, only 3 of the 50 participants chose the “neither” option, and the majority (62%) favored the DDART format. In a subsequent question, participants could only select MTF or DDART as a response, and were forced to choose between the two formats.

Table 3 displays the forced format preferences selected by the participants. A chi-square test yielded a significant preference for the DDART format over the MTF, \(\chi^2(2) = 5.12, p = .024\).

Table 3: Number and Percent of Respondents Preferring MTF or DDART

<table>
<thead>
<tr>
<th>Ranking Format</th>
<th>MTF</th>
<th>DDART</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of Preferences</td>
<td>17 (34)</td>
<td>33 (66)</td>
<td>50 (100)</td>
</tr>
</tbody>
</table>

*Note. Percentages in parentheses.*

Usability

Table 4 displays the means and standard deviations of each format’s SUS scores, which are based on a 100 point scale. A repeated measures multivariate analysis of variance (MANOVA) resulted in no difference in the scores between the two formats \(F(1, 48) = .416, MSE = 578.068, p = .522\).

Participants also answered two open-ended questions concerning why they either liked or disliked the two formats. DDART had 33 \((n = 50)\) positive comments while MTF garnered only 17 \((n = 50)\) positive comments. Eleven of 50 participants specifically mentioned that MTF was not preferred because they had to rank every aspect before they
could reposition them. Eighteen of 50 participants reported that they preferred DDART because it was easier to “keep track of/remember used aspects.”

*Table 4: Mean Usability Scores for MTF and DDART Formats*

<table>
<thead>
<tr>
<th>Ranking Task Format</th>
<th>MTF</th>
<th>DDART</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean SUS Score</td>
<td>65.43 (23.02)</td>
<td>71.03 (20.17)</td>
</tr>
</tbody>
</table>

*Note.* Standard deviations in parentheses.

**Repositioned Rankings**

Table 5 displays the means and standard deviations of the number of repositioned rankings. The available technology allowed DDART to record the number of repositioned rankings electronically while the experiment was in progress; however, this technology was not available to collect MTF repositioned rankings data. Participants reported the number of times they repositioned their rankings under each format after they had completed both ranking task formats.

*Table 5: Mean Number of Repositioned Rankings*

<table>
<thead>
<tr>
<th>Ranking-task Format</th>
<th>MTF (Reported)</th>
<th>DDART (Reported)</th>
<th>MTF (Recorded)</th>
<th>DDART (Recorded)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1.72 (1.79)</td>
<td>1.63 (2.10)</td>
<td>N/A</td>
<td>1.96 (5.49)</td>
</tr>
<tr>
<td></td>
<td><em>n = 32</em></td>
<td><em>n = 25</em></td>
<td><em>N/A</em></td>
<td><em>n = 9</em></td>
</tr>
</tbody>
</table>

*Note.* Standard deviations in parentheses.

The mean number of recorded DDART repositionings was higher than the mean number reported by participants. The recorded data indicated that 9 of the 46 participants repositioned their DDART rankings. However, 25 participants reported repositioning
their rankings for the DDART format. In addition, 32 participants reported repositioning their rankings when using MTF even though they were never explicitly told in the task instructions that they could reposition the rankings. However, the data are inconclusive and somewhat unreliable since the actual number of repositionings was not recorded for MTF.

**Ranking Relationships**

A strong relationship existed between the rankings of the two formats. Table 6

*Table 6: Means and Standard Deviations of Rankings and Ratings for Each Aspect*

<table>
<thead>
<tr>
<th>Aspect</th>
<th>MTF Ranking</th>
<th>DDART Ranking</th>
<th>Rating</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean</td>
<td>SD</td>
<td>Mean</td>
</tr>
<tr>
<td>Academics</td>
<td>4.91</td>
<td>4.00</td>
<td>5.30</td>
</tr>
<tr>
<td>Available Majors</td>
<td>4.61</td>
<td>4.25</td>
<td>4.70</td>
</tr>
<tr>
<td>Specials Programs</td>
<td>11.61</td>
<td>3.76</td>
<td>12.26</td>
</tr>
<tr>
<td>Student Attention</td>
<td>6.72</td>
<td>4.06</td>
<td>6.72</td>
</tr>
<tr>
<td>Academic Facilities</td>
<td>8.41</td>
<td>3.96</td>
<td>8.70</td>
</tr>
<tr>
<td>Recreational Facilities</td>
<td>10.04</td>
<td>4.03</td>
<td>9.30</td>
</tr>
<tr>
<td>Campus Housing</td>
<td>9.17</td>
<td>4.13</td>
<td>9.07</td>
</tr>
<tr>
<td>Neighborhood</td>
<td>8.87</td>
<td>4.30</td>
<td>9.22</td>
</tr>
<tr>
<td>Campus Attractiveness</td>
<td>6.87</td>
<td>3.58</td>
<td>7.13</td>
</tr>
<tr>
<td>Cost</td>
<td>9.20</td>
<td>5.55</td>
<td>9.39</td>
</tr>
<tr>
<td>Social Life</td>
<td>8.11</td>
<td>4.23</td>
<td>7.13</td>
</tr>
<tr>
<td>City Activities</td>
<td>12.37</td>
<td>4.06</td>
<td>12.46</td>
</tr>
<tr>
<td>Extracurricular Activities</td>
<td>10.11</td>
<td>4.15</td>
<td>9.98</td>
</tr>
<tr>
<td>Quality of Majors</td>
<td>6.74</td>
<td>3.99</td>
<td>6.09</td>
</tr>
<tr>
<td>Reputation</td>
<td>8.76</td>
<td>4.26</td>
<td>9.24</td>
</tr>
<tr>
<td>Academic Environment</td>
<td>9.50</td>
<td>3.98</td>
<td>9.33</td>
</tr>
</tbody>
</table>
displays the means and standard deviations of the rankings (a range of 1-16, 1 being the highest ranking in terms of importance) and ratings (a range of 1-6, 6 being the highest rating in terms of importance) for each aspect.

A one-tailed test was used to evaluate each correlation in order to increase sensitivity in detecting significance. Table 7 displays the Pearson product-moment correlation coefficients of the 16 aspect rankings for each of the two formats. All correlations were significant, $p < .005$.

Table 7: Correlations and Significance of Corrections Between MTF and DDART Rankings for each Aspect

<table>
<thead>
<tr>
<th>Aspect</th>
<th>Correlations Between Rankings (1-tailed)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Academics</td>
<td>.723****</td>
</tr>
<tr>
<td>Available Majors</td>
<td>.735****</td>
</tr>
<tr>
<td>Specials Programs</td>
<td>.674***</td>
</tr>
<tr>
<td>Student Attention</td>
<td>.382*</td>
</tr>
<tr>
<td>Academic Facilities</td>
<td>.561****</td>
</tr>
<tr>
<td>Recreational Facilities</td>
<td>.692***</td>
</tr>
<tr>
<td>Campus Housing</td>
<td>.446**</td>
</tr>
<tr>
<td>Neighborhood</td>
<td>.831****</td>
</tr>
<tr>
<td>Campus Attractiveness</td>
<td>.798***</td>
</tr>
<tr>
<td>Cost</td>
<td>.810****</td>
</tr>
<tr>
<td>Social Life</td>
<td>.827****</td>
</tr>
<tr>
<td>City Activities</td>
<td>.822****</td>
</tr>
<tr>
<td>Extracurricular Activities</td>
<td>.686****</td>
</tr>
<tr>
<td>Quality of Majors</td>
<td>.720***</td>
</tr>
<tr>
<td>Reputation</td>
<td>.616***</td>
</tr>
<tr>
<td>Academic Environment</td>
<td>.532****</td>
</tr>
<tr>
<td>Mean</td>
<td>.695</td>
</tr>
<tr>
<td>SD</td>
<td>.240</td>
</tr>
</tbody>
</table>

*Note. * $p < .005$. ** $p = .001$. *** $p < .0001$. 
A strong positive correlation also existed between the aspect rankings and aspect ratings obtained under each format. Table 8 displays these correlations and the associated 1-tailed significance levels. A 1-tail test of significance was based on the findings of Alwin and Krosnick (1985).

Table 8: Correlations and Significance of Correlations of MTF and DDART Rankings and Ratings for Each Aspect

<table>
<thead>
<tr>
<th>Aspect</th>
<th>MTF</th>
<th>DDART</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>( r )</td>
<td>Sig. (1-tailed)</td>
</tr>
<tr>
<td>Academics</td>
<td>.602</td>
<td>&lt;.0001</td>
</tr>
<tr>
<td>Available Majors</td>
<td>.566</td>
<td>&lt;.0001</td>
</tr>
<tr>
<td>Specials Programs</td>
<td>.596</td>
<td>&lt;.0001</td>
</tr>
<tr>
<td>Student Attention</td>
<td>.536</td>
<td>&lt;.0001</td>
</tr>
<tr>
<td>Academic Facilities</td>
<td>.463</td>
<td>.001</td>
</tr>
<tr>
<td>Recreational Facilities</td>
<td>.496</td>
<td>&lt;.0001</td>
</tr>
<tr>
<td>Campus Housing</td>
<td>.565</td>
<td>&lt;.0001</td>
</tr>
<tr>
<td>Neighborhood</td>
<td>.534</td>
<td>&lt;.0001</td>
</tr>
<tr>
<td>Campus Attractiveness</td>
<td>.479</td>
<td>&lt;.0001</td>
</tr>
<tr>
<td>Cost</td>
<td>.480</td>
<td>&lt;.0001</td>
</tr>
<tr>
<td>Social Life</td>
<td>.627</td>
<td>&lt;.0001</td>
</tr>
<tr>
<td>City Activities</td>
<td>.402</td>
<td>.003</td>
</tr>
<tr>
<td>Extracurricular Activities</td>
<td>.411</td>
<td>.002</td>
</tr>
<tr>
<td>Quality of Majors</td>
<td>.474</td>
<td>&lt;.0001</td>
</tr>
<tr>
<td>Reputation</td>
<td>.505</td>
<td>&lt;.0001</td>
</tr>
<tr>
<td>Academic Environment</td>
<td>.480</td>
<td>&lt;.0001</td>
</tr>
<tr>
<td>Mean</td>
<td>.515</td>
<td></td>
</tr>
<tr>
<td>SD</td>
<td>.09</td>
<td></td>
</tr>
</tbody>
</table>

All correlations between ranking and rating formats were significant to the .001 level, with the exception of Campus Housing, which did not attain significance under the DDART format. The mean correlations (\( r = .515; \ r = .525 \)) between the two formats were approximately equal, but there was greater variability among the DDART
correlations, which could be attributed to the non-significant outlying correlation \( r = .106 \) of the campus housing aspect.

**Decision-Making Sequences**

Of the 100 decision-making sequences reported, 16 were eliminated from the analysis for one of two reasons: the participant either did not follow the directions to complete the sequence \( (n = 13) \), or reported attempting to remember the ranks they had assigned for the previous ranking-task \( (n = 3) \). Figure 9 shows the frequency of use of these strategies.

The figure illustrates that participants used the four strategies in approximately the same pattern under both the MTF and the DDART formats. Participants used the
Level Driven strategy the most frequently under both formats. In terms of overall use, 41.67% ($n = 84$) selected strategies were Level Driven, 19% Similar Option Driven, 28.6% Numeric Rank Driven, and 10.8% Individual Option Driven. The chunking strategies, Level Driven and Similar Option Driven, were favored over the non-chunking Numeric Rank Driven and Individual Option Driven strategies.
Chapter IV

Discussion

The previous three chapters described ranking-task formats, the problems associated with ranking-tasks, and the implementation and testing of a new ranking-task format. Discussed below are the outcomes of the dependent variables: completion time, format preference, mean SUS scores, mean number of repositioned rankings, the relationships between the format rankings, the relationships between format rankings and ratings, and the strategies based on the participants’ decision-making sequences. Also discussed is how the concepts implemented in DDART successfully addressed many of the problems associated with ranking, as well as possible new enhancements that could be implemented to improve the functionality of DDART as a ranking-task format.

Recorded/Perceived Completion Time

Recorded completion time for MTF was expected to be significantly higher than that of DDART; however, the completion times for the first trial of the two formats differed by only 70 milliseconds (Table 2). As participants were most likely well-experienced in completing a ranking-task using a pencil and paper format analogous to MTF, it is remarkable that they completed the new experimental format, DDART, in an equivalent completion time. Apparently, there are no transfer of training conflicts.
It should be noted that in the second trial of the two formats, DDART was completed almost 10 seconds faster than MTF (Table 2). This suggests that with further exposure, participants would continue to reduce average completion times when completing the DDART format.

Although recorded completion times were not significantly different, 32 of the 50 participants reported that DDART allowed them to complete the task faster, while only 9 of the 50 participants reported that they believed that they completed the task faster under the MTF condition. Based on these findings, it is expected that participants would also prefer DDART when completing future ranking-tasks. This expectation is addressed immediately below.

**Format Preference**

Significantly more participants (33 of 50) preferred using DDART to MTF. The margin of almost 2 to 1 is impressive for an experimental format. Since participants preferred the DDART format, one could expect that they would take the task more seriously and have more motivation to complete the task than if it was less preferable. Had the task been too frustrating, participants may not have completed the task to the best of their ability, providing unreliable rankings.

In response to an open-ended question, 18% of the participants explicitly reported the importance of being able to see an ordered complete list of ranked options before they submitted their completed rankings. The lack of this feature in traditional ranking-tasks, with the exception of the card-sorting method as described by Parten (1950), which was noted in Chapter 1. This testimony from participants suggests that the ability to view the ordered list of rankings would reduce respondent burden.
Usability

It was predicted that DDART would be more usable than MTF because of the likelihood that participants use drag-and-drop technology on a daily basis; however, DDART did not achieve a significantly higher mean usability rating as measured by SUS. (i.e., it was not rated as more usable). Had participants not been using DDART for the first time, its SUS score could have been significantly higher. However, when specifically asked which format was easier to use, 33 of 50 participants reported that DDART was easier to use than MTF.

Since MTF is based on a more commonly used ranking format, it is remarkable that DDART’s SUS score, while not significantly higher than that of the MTF, is still higher than the MTF. Therefore, this notion, coupled with two-thirds of participants reporting that DDART is easier to use than MTF, indicates that DDART’s usability is comparable to if not an improvement over MTF.

Repositioned Rankings

It was predicted that participants would significantly reposition more rankings using DDART because DDART was designed to make the repositioning portion of the ranking-task easier. However, since participants reported an average of 1.79 repositionings using MTF and 1.63 repositionings using DDART, the hypothesis was not confirmed. One explanation suggests that participants may have repositioned fewer rankings using DDART because they had initially positioned their rankings in the desired order. Conversely, 8 of the 17 participants who preferred MTF reported frustration with DDART, because they had to rank all aspects before they could begin repositioning.
Based on these findings, the ability to reorder aspects before all aspects have been ranked would increase the acceptability of DDART.

**Ranking Relationships**

Each aspect ranking for MTF was significantly correlated to its respective DDART aspect ranking (Table 7). This is important because it illustrates that data garnered from DDART are closely related to that of traditional ranking-tasks, and that DDART will produce similar results when DDART is used as an alternative to traditional models.

As an alternative to ranking, Alwin and Krosnick (1985) proposed ratings, because ratings data are highly correlated with ranking data and ratings are less troublesome to complete, particularly when there are more than seven options. Similar results about the relationship between ranking and rating were found in this study (Table 8). Indeed, each aspect rating was significantly correlated to each aspect MTF ranking and each aspect rating (with the exception of campus housing) was significantly correlated with each DDART ranking.

Research described in Chapter 1 (Wiley, 1996; Oppenheim, 1966; Sudman & Bradburn, 1982), illustrated how paired comparisons are a commonly used alternative to ranking-tasks when there are more than seven options to consider. However, it should be noted that the number of possible comparisons increases as described by the equation \( \frac{1}{2}N(N-1) \). Thus, if the 16 aspects considered in this experiment were to be evaluated using this method, a total of 120 comparisons would have been required. It is difficult to envision participants reliably completing such a tedious task. Fortunately, considering both the participants’ preference for DDART and the significant relationship between
DDART rankings and aspect ratings, DDART, would be a preferred alternative to both paired comparisons and traditional ranking-tasks when such a large number of options need to be compared.

**Ranking Strategies**

As displayed in Figure 9, the proportion of the respondents using each of the four ranking strategies is approximately the same under both the MTF and DDART conditions. However, the frequency of use between the four strategies was significantly different. It is apparent that the Level Driven Strategy and Numeric Rank Driven Strategy were the two most popular among participants. Even though one of these strategies is chunking and the other is non-chunking, the two strategies are similar, since in both cases the respondent first chooses a ranking position and then searches for an aspect to assign to that position.

When assigning rankings, users of the Level Driven strategy first form ranking chunks at the extremes (i.e., high importance or low importance), while users of the Numeric Rank Driven strategy, a non-chunking strategy, first choose a specific ranking position and then search the options to determine which options should be placed in that ranking position. For example, a user of the Numeric Rank Driven Strategy chooses the first ranking, the highest degree of importance, and searches the options for the aspect which he/she considers the most important; and then assigns that aspect to the first ranking position. Conversely, participants who use Similar Option Driven and Individual Option Driven strategies first select the options (not the level of importance), and then assign a rank by estimating where the options should be placed. Thus, these participants select an aspect such as “Academic Reputation” and then estimate the rank which he/she
considers appropriate for that aspect. This relationship between the strategies is important since 70% of the participants used either the Level Driven or the Numeric Rank Driven strategies. The majority of participants completed the task by choosing a ranking position and then searched for an aspect to insert into that position, as opposed to choosing an aspect and then assigning a rank to that particular aspect.

Considerations for Future Studies

Future studies must address three concerns related to repositioning rankings. First, the number of repositioned rankings must be recorded under both the DDART and MTF conditions. This capability is critical because of the wide disparity between the number of recorded DDART repositionings and the number of reported DDART repositionings. This capability would allow the recorded MTF repositioning data to be compared to the recorded DDART repositioning data, which would provide more insight into the strategies participants used in completing ranking-tasks.

Second, participants should also be allowed to reposition their rankings under both DDART and MTF conditions, before they complete the initial ranking process. The inability of user to do this for the MTF was reported as a flaw by almost half of the participants (8 of 17) who preferred MTF to DDART.

Third, an oversight with this thesis concerned the directions for completing the ranking when using the MTF format needs to be corrected. Participants were not explicitly instructed that, under the MTF condition, they could assign a different ranking to an option after they had initially assigned a ranking. However, the directions provided in the DDART instructions did indicate that this capability was available. This oversight should be remedied for consistency between the two formats.
Experimenters should also consider a feature where the options column compresses vertically when an option has been removed and placed in the response column. By implementing this feature, there would no longer be empty cells to scan, therefore, reducing visual noise and, more than likely, completion times as well.

Finally, future experimenters should randomize the options before rankings are assigned to them. Randomization would assist in combating any ordering effects that may occur between the options.

**Conclusion**

Although traditional ranking procedures are not recommended when a large number of options need to be prioritized, the present study indicates that drag-and-drop technology, exemplified by DDART, addresses many of the problems associated with traditional ranking-tasks as represented by MTF. Participants preferred DDART and found it easier to use than the MTF. Participants also completed DDART in almost the same elapsed time during the initial trial as they did using the more familiar traditional ranking-task format. Indeed, it is likely that with increased exposure to DDART, participants could continue to complete it in less time than when using traditional ranking-task formats, as embodied in the MTF.

The significant positive correlation between the ranking data of the two formats indicates that data garnered by DDART are comparable to data produced by traditional ranking-tasks. The significant positive correlation between the aspect ratings and the DDART rankings indicates that DDART is also comparable to traditional ranking-task alternatives.
I believe that DDART was comparable if not an improvement over MTF.

Enhancements of DDART, such as allowing for the rearrangement of options at any time, would facilitate its acceptance as an alternative to traditional ranking-tasks.
References


Appendix A

Informed Consent to Participate as a Research Subject

**Project Title:** “New Student Enrollment Process Survey”

**Investigators:** Stephen Karth and William F. Moroney Ph.D.

**Expected Duration of Study:** Approximately one hour.

**Procedure:** The task will include completing various questionnaires including a demographic questionnaire, a preferences questionnaire, and questions about preferences related to the UD application/enrollment process.

**Confidentiality:** No records of your participation in this research will be disclosed to others. Your data will be pooled with data from other research participants and only summary results will be made public. These summary results will also be shared with the admissions department to further improve the admissions process. Your name will not be revealed in any document resulting from this research.

**Contact Person for Questions or Problems:** If a research-related injury concern arises, or if you have questions about the research, contact Stephen Karth, karthstt@notes.udayton.edu, 231-3629, or Dr. William F. Moroney, william.moroney@notes.udayton.edu, in SJ 305, 937-229-2967. Questions about the rights of the subject should be addressed to Charles E. Kimble, Ph.D., charles.kimble@notes.udayton.edu, in SJ 319, 937-229-2167.

**Anticipated Risks or Discomfort:** There are no anticipated risks or discomfort that would arise from participation in this study.

**Consent to participate:** I have voluntarily decided to participate in this research project. The investigators named above have adequately answered all questions that I have about this research, the procedures involved, and my participation. I understand that the investigators named above, or one if his assistants, will be able to answer any questions about the experimental procedures throughout this research. I also understand that I may refuse to participate or voluntarily terminate my participation in this research at any time without penalty or loss of benefits to which I am entitled. The investigators may also
terminate my participation in this research if they feel this to be in my best interest. In addition, I certify that I am 18 (eighteen) years of age or older.

Student Name (this serves as your signature):

Date: (MM/DD/YYYY):

Signature of Investigator:

Participation in this research will result in 1 research credit for the term.
Appendix B

UD Admissions Questions, Part 1

For this portion of the survey, please click the option that most closely corresponds to your answer.

1. How many institutions did you apply to?
   - 1
   - 2
   - 3
   - More than 3

2. How many of these institutions were you admitted to?
   - 1
   - 2
   - 3
   - More than 3

3. Did you apply to any of these schools? (Select all that apply)
   - The Ohio State University
   - Wright State University
   - Miami University
   - Sinclair Community College
   - I did not apply to any of these schools.

4. Were you accepted to any of these schools? (Select all that apply)
   - The Ohio State University
   - Wright State University
   - Miami University
   - Sinclair Community College
   - I was not accepted to any of these schools.
5. What year of High School did you begin looking for colleges?
   - Before my First Year
   - My First Year
   - My Sophomore Year
   - My Junior Year
   - My Senior Year
   - After my Senior Year

The following questions are related to how you obtained information about the University. Please select the answer that most closely reflects how helpful (based on the quality of information given) the following sources were to you.

6. The quality of the visits by the University of Dayton admissions staff to your high school were:
   - I did not attend these visits.
   - Poor
   - Fair
   - Good
   - Very Good
   - Excellent
   - There were no visits by the admissions staff to my high school.

7. The quality of the University of Dayton sponsored meetings in your home area were:
   - I did not attend these meetings.
   - Poor
   - Fair
   - Good
   - Very Good
   - Excellent
   - There were no meetings in my home area.

8. The quality of the University of Dayton Publications (catalogs, brochures, etc.) was:
   - Not Used
   - Poor
   - Fair
   - Good
   - Very Good
   - Excellent
   - Not given to me.
9. The quality of the College videos or CD-ROMs were:
   - I did not use these.
   - Poor
   - Fair
   - Good
   - Very Good
   - Excellent

10. The quality of the communications about financial aid (not the aid decision) was:
    - I did not have these communications.
    - Poor
    - Fair
    - Good
    - Very Good
    - Excellent

11. The quality of the electronic communications with the campus was:
    - I did not use electronic communications.
    - Poor
    - Fair
    - Good
    - Very Good
    - Excellent

12. The quality of the campus visits were:
    - I did not make any campus visits.
    - Poor
    - Fair
    - Good
    - Very Good
    - Excellent

13. The on-campus admissions interview was:
    - Not used
    - Poor
    - Fair
    - Good
    - Very Good
    - Excellent
14. The quality of the contacts with the faculty from the university was:
   - I did not contact any faculty from the university.
   - Poor
   - Fair
   - Good
   - Very Good
   - Excellent

15. The quality of the contacts with coaches before I was admitted was:
   - I did not contact any coaches.
   - Poor
   - Fair
   - Good
   - Very Good
   - Excellent

16. The quality of the contacts with the graduates of the university before I was admitted was:
   - I did not contact any university graduates.
   - Poor
   - Fair
   - Good
   - Very Good
   - Excellent

17. The quality of the contacts with the students who attend the university was:
   - I did not contact any students who attend the university.
   - Poor
   - Fair
   - Good
   - Very Good
   - Excellent

Please click “Submit” to continue.

(Submit)
Appendix C

DDART Practice Task

Before we move on to the next question, I would like to familiarize you with our ranking procedure, by using the following example. For the following question I ask you to rank five different types of cookies from your most favorite to your least favorite. There are 5 cookies in total to rank. Please place the type of cookie you like the most in the 1st position, the type of cookie you like the 2nd most in the 2nd position, and so on until all the types of cookies have been ranked. This is accomplished by dragging and dropping the various types cookies. Click and hold the left mouse button on a cookie type and drag it to desired rank position in the adjacent column. Release the mouse button to drop the type of cookie in the desired position. Once all types of cookies have been ranked, changes can be made. Changes can be made by dragging the type of cookie you wish to move up or down to the position you prefer. Types are cookies that that are not being moved will slide or up or down depending on where you reposition your selected cookie type. Once you are satisfied with the rankings, please click the submit button to continue. You may also click the reset button if you wish to start over.

<table>
<thead>
<tr>
<th>Option column</th>
<th>Response column</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chocolate Chip</td>
<td>1. &lt;empty&gt;</td>
</tr>
<tr>
<td>Oatmeal Rasin</td>
<td>2. &lt;empty&gt;</td>
</tr>
<tr>
<td>Sugar</td>
<td>3. &lt;empty&gt;</td>
</tr>
<tr>
<td>Ginger</td>
<td>4. &lt;empty&gt;</td>
</tr>
<tr>
<td>Peanut Butter</td>
<td>5. &lt;empty&gt;</td>
</tr>
</tbody>
</table>
Appendix D

MTF Practice Task

Before we move on to the next question, I would like to familiarize you with our ranking procedure, by using the following example. I ask that you rank five different types of cookies from your most favorite to your least favorite. There are 5 cookie types in total to rank. Place a 1 in front of the type of cookie that you like the most, a 2 in front of your second choice and so on until all cookie types have been ranked. Each number (1-5) can only be used once, which means two types of cookie cannot have the same rank. When you have ranked all of the types of cookies, please click the submit button. If you wish to start over at any point during your ranking process, please hit the reset button.

- Chocolate Chip
- Oatmeal Rasin
- Sugar
- Ginger
- Peanut Butter

Submit  Reset
Appendix E

DDART Trial

Using the same procedure as the example you just completed, the following question will require you to rank various aspects of University of Dayton. This time you will rank the various aspects of the University according to how important they were in your decision to attend. There are 16 aspects in total. Please place the aspect that meant the most to you in the 1st position, the issue that meant the 2nd most to you to you in the 2nd position and so on until all items have been ranked. Just as with the cookie types, this is accomplished by dragging and dropping the various aspects. Click and hold on an aspect and then drag it to the adjacent column and place it in the position you wish to rank it. Release the mouse button to drag the aspect in the desired slot. Once all aspects have been ranked, changes can be made. Click and hold the desired aspect and then drag it up or down depending on where you would like to position it. Aspects that are not being moved will slide or up or down depending on where you drag your selected aspect. Release the mouse button to drop the aspect in the desired position. Once you are satisfied with the rankings, please click the submit button to continue. You may also click the reset button if you wish to start over.

<table>
<thead>
<tr>
<th>Option column</th>
<th>Response column</th>
</tr>
</thead>
<tbody>
<tr>
<td>Academic reputation</td>
<td>1. &lt;empty&gt;</td>
</tr>
<tr>
<td>Availability of majors if interest to you</td>
<td>2. &lt;empty&gt;</td>
</tr>
<tr>
<td>Special academic programs (honors programs, etc.)</td>
<td>3. &lt;empty&gt;</td>
</tr>
<tr>
<td>Personal attention to students</td>
<td>4. &lt;empty&gt;</td>
</tr>
<tr>
<td>Quality of academic facilities (Library, etc.)</td>
<td>5. &lt;empty&gt;</td>
</tr>
<tr>
<td>Availability of recreational facilities on campus</td>
<td>6. &lt;empty&gt;</td>
</tr>
<tr>
<td>Quality of on-campus housing</td>
<td>7. &lt;empty&gt;</td>
</tr>
<tr>
<td>Campus Surroundings (Neighborhood)</td>
<td>8. &lt;empty&gt;</td>
</tr>
<tr>
<td>Campus Attractiveness</td>
<td>9. &lt;empty&gt;</td>
</tr>
<tr>
<td>Cost (after scholarships and grants)</td>
<td>10. &lt;empty&gt;</td>
</tr>
<tr>
<td>Quality of social life</td>
<td>11. &lt;empty&gt;</td>
</tr>
<tr>
<td>Off campus cultural &amp; recreational opportunities</td>
<td>12. &lt;empty&gt;</td>
</tr>
<tr>
<td>Opportunities for extracurricular Activities</td>
<td>13. &lt;empty&gt;</td>
</tr>
<tr>
<td>Quality of Majors of interest to you</td>
<td>14. &lt;empty&gt;</td>
</tr>
<tr>
<td>Reputation of college for potential employers</td>
<td>15. &lt;empty&gt;</td>
</tr>
<tr>
<td>Environment that stresses academic excellence</td>
<td>16. &lt;empty&gt;</td>
</tr>
</tbody>
</table>
Appendix F

MTF Trial

Using the same procedure as the example you just completed, the following question will require you to rank various aspects of the University according to how important they were in your decision to attend. There are 16 aspects to rank. Place a 1 in front of the aspect of the University that meant the most to you, a 2 in front of your second most meaningful aspect, and so on until all the aspects have been ranked. Each number (1-16) can only be used once, which means two aspects cannot have the same rank. When you have ranked all aspects, please click the submit button. If you wish to start over at any point during your ranking process, please hit the reset button.

- Academic reputation
- Availability of majors if interest to you
- Special academic programs (honors programs, etc)
- Personal attention to students
- Quality of academic facilities (Library, etc)
- Availability of recreational facilities on campus
- Quality of on-campus housing
- Campus Surroundings (Neighborhood)
- Campus Attractiveness
- Cost (after scholarships and grants)
- Quality of social life
- Off campus cultural & recreational opportunities
- Opportunities for extracurricular Activities
- Quality of Majors of interest to you
- Reputation of college for potential employers
- Environment that stresses academic excellence

Submit  Reset
Appendix G

UD Admissions Questions, Part 2

The following questions address financial aid information. Your information will be kept anonymous. Please select the option that most closely reflects your circumstances.

20. Was the cost of the University of Dayton a significant factor in your decision to attend?
   - Yes
   - No
   - Don’t Know

21. Was the University’s financial aid package a significant factor in your decisions to attend?
   - Yes
   - No

22. Did you apply for need based financial aid?
   - Yes
   - No
   - Don’t Know

23. Were you offered need based financial aid?
   - Yes
   - No
   - Don’t Know

24. Were you offered a non-need-based scholarship by the college in recognition of you athletic, musical, or academic abilities?
   - Yes
   - No
   - Don’t Know
25. Did your financial aid package include: (Please check all that apply)
   - Grants or Scholarships
   - One or more student loans
   - A work package or campus job
   - My Financial Aid Package did not contain any of these
   - I do not know what was in my financial aid package
   - I do not have a financial aid package

26. After subtracting grants or scholarships only, if any, please rate the cost to you and your family of attending the University of Dayton.
   - Very Low Cost
   - Moderately Low Cost
   - Neither too High or Low Cost
   - Moderately High Cost
   - Very High Cost

The following questions will ask you about your personal information. Again, please remember all information is kept anonymous.

27. What is your gender?
   - Male
   - Female

28. Are you a resident of Ohio? (Permanent Address)
   - Yes
   - No

29. How far is the University of Dayton from your home?
   - Less than 50 miles
   - 50 to 100 miles
   - 101 to 300 miles
   - 301 to 500 miles
   - More than 500 miles

30. Which of the following best describes the type of high school you attended?
   - Public
   - Independent, Not Religious Affiliated
   - Independent, Catholic
   - Other Independent, Religiously Affiliated
30. How do you describe yourself? (Please choose one answer)

- Native American or Native Alaskan
- Asian, Asian American or Pacific Islander
- Mexican American or Chicano
- Puerto Rican
- Latin American, South American or other Hispanic
- Black or African American
- White or Caucasian
- Arab or Persian
- Prefer not to specify.
- Please specify if not listed: ______________

Please click “Submit” to continue.

(Submit)
Appendix H

Procedures Questionnaire

The following questionnaires concern the different formats you used to complete the ranking tasks. The “drag and drop” format is the format where you dragged aspects from column to column. The “write-in” format is the format where you typed a number in front of the aspects.

For this portion of the experiment, we ask you to describe the strategies you used to rank the various aspects of the University of Dayton. To help us understand your decision making process, we ask you to construct two step-by-step decision making sequences describing your decisions as you completed the ranking processes. To help you construct your decision making sequences, we have provided the following examples:

A person with roughly a size 10 foot, purchasing a pair of shoes, might construct a decision making sequence similar to this:

1. Searched shoe styles at store.
2. Selected a pair of shoes, based on color and style.
3. Requested a size 10.
4. Tried the shoes.
5. Checked for comfort. Decided the shoes were too tight.
6. Requested and tried a size 11.
7. Checked for comfort. Decided the shoes were too loose.
8. Requested and tried a size 10½.
9. Checked for comfort. The shoes fit and were the desired color and style.
10. Decided to purchase the shoes.

There are no right or wrong strategies in how YOU ranked the aspects. So, another person’s decision making sequence for shoe purchasing might look like this:

1. Searched shoe styles at store.
2. Based on style and color, the store had no desirable shoes.
3. Decided to go to a different store, where shoes were organized by size.
4. Found the size 10 section.
5. Searched for a desirable color and style.
6. Selected a pair of shoes, based on style and color.
7. Requested a size 10 and tried the shoes.
8. Checked for comfort and desired appearance.
9. The shoes fit, and were of desirable appearance.
10. Decided to purchase the shoes.
On the pages that follow, please construct your decision making sequence for both the **drag and drop** and the **write-in** formats. There are 2 sets of 15 procedure lines, similar to the examples provided above. You may use as many or as few lines as you need. There are no right or wrong answers. When you have completed, please continue to the next set of questions.
Describe the decision making process you used in completing the drag and drop format:

1. __________________________________________________________________________

2. __________________________________________________________________________

3. __________________________________________________________________________

4. __________________________________________________________________________

5. __________________________________________________________________________

6. __________________________________________________________________________

7. __________________________________________________________________________

8. __________________________________________________________________________

9. __________________________________________________________________________

10. __________________________________________________________________________

11. __________________________________________________________________________

12. __________________________________________________________________________

13. __________________________________________________________________________

14. __________________________________________________________________________

15. __________________________________________________________________________
Describe the **decision making process** you used in completing the **write-in** format:

1. ____________________________________________

2. ____________________________________________

3. ____________________________________________

4. ____________________________________________

5. ____________________________________________

6. ____________________________________________

7. ____________________________________________

8. ____________________________________________

9. ____________________________________________

10. ___________________________________________

11. ___________________________________________

12. ___________________________________________

13. ___________________________________________

14. ___________________________________________

15. ___________________________________________
For this portion of the survey, please circle the option that most closely corresponds to how you completed each ranking task:

The following 5 questions concern only the write-in format:

1. I reassigned a rank to at least 1 aspect of the University of Dayton from the initial rank that I assigned to it when using the write-in format:
   a. Yes (35 of 50)
   b. No  (Please go to question #4 below) (15 of 50)

2. I reassigned ______ number of aspects(s) when using the write-in format:
   a. 1-2 (15 of 35)
   b. 3-4 (16 of 35)
   c. 5-6 (3 of 35)
   d. 7-8 (0 of 35)
   e. More than 8 (1 of 35)

3. Using the write-in format, I reassigned these aspects:
   a. Before I had initially ranked all of the aspects. (11 of 35)
   b. After I had initially ranked all of the aspects. (15 of 35)
   c. Both before and after I had ranked all of the aspects. (9 of 35)

4. After reading the statement below, please check the response that most closely describes your reviewing process using the write-in format.
   I very carefully reviewed the rankings before I clicked the submit button using the write-in format.
   ___ Strongly Agree (9 of 50)
   ___ Somewhat Agree (10 of 50)
   ___ Slightly Agree (15 of 50)
   ___ Slightly Disagree (10 of 50)
   ___ Somewhat Disagree (2 of 50)
   ___ Strongly Disagree (2 of 50)
   ____ I Did not review my final rankings. (2 of 50)

5. When determining the importance of the aspects list in the write-in format, I first assigned ranks to the most important and/or least important aspects and then ranked the reminding aspects.
   ___ Strongly Agree (22 of 50)
   ___ Somewhat Agree (16 of 50)
   ___ Slightly Agree (6 of 50)
   ___ Slightly Disagree (4 of 50)
   ___ Somewhat Disagree (2 of 50)
   ___ Strongly Disagree (0 of 50)
The following 5 questions concern only the **drag and drop** format:

1. I moved at least 1 aspect from the location where I had initially placed it when using the **drag and drop** format:
   a. Yes (27 of 50)
   b. No (**Please go to question #3 below**) (23 of 50)

2. I moved _______ number of aspects(s) when using the **drag and drop** format:
   a. 1-2 (10 of 27)
   b. 3-4 (9 of 27)
   c. 5-6 (6 of 27)
   d. 7-8 (2 of 27)
   e. More than 8 (0 of 27)

3. After reading the statement below, please check the response that most closely describes your reviewing process using the **drag and drop** format.

   I very carefully reviewed the rankings before I clicked the submit button using the **drag and drop** format.

   ___ Strongly Agree (8 of 50)
   ___ Somewhat Agree (16 of 50)
   ___ Slightly Agree (9 of 50)
   ___ Slightly Disagree (7 of 50)
   ___ Somewhat Disagree (5 of 50)
   ___ Strongly Disagree (3 of 50)
   ___ **I did not** review my rankings. (2 of 50)

4. After reading the statement below, please check the response that most closely describes your opinion of the **drag and drop** format.

   It was frustrating that I could not move aspects that I had ranked until **AFTER** I ranked all of the aspects using the **drag and drop** format.

   ___ Strongly Agree (20 of 50)
   ___ Somewhat Agree (11 of 50)
   ___ Slightly Agree (12 of 50)
   ___ Slightly Disagree (2 of 50)
   ___ Somewhat Disagree (1 of 50)
   ___ Strongly Disagree (4 of 50)
5. When determining the importance of the aspects list in the drag and drop format, I first assigned ranks to the most important and/or least important aspects and then ranked the remaining aspects.

___ Strongly Agree (24 of 50)
___ Somewhat Agree (17 of 50)
___ Slightly Agree (4 of 50)
___ Slightly Disagree (3 of 50)
___ Somewhat Disagree (2 of 50)
___ Strongly Disagree (0 of 50)
Appendix I

Format Preference Questionnaire

The following questions concern both ranking formats. Please place a checkmark in front of the response that most closely reflects your opinion.

1. Which format did you prefer?
   ____ Drag and Drop (Please skip to question #3) (31 of 50)
   ____ Write-In (Please skip to question #3) (16 of 50)
   ____ Did not prefer either format. (Please answer question #2 and continue) (3 of 50)

2. If you were forced to make a choice of format preference, which format would you prefer?
   ____ Drag and Drop (33 of 50)
   ____ Write-In (17 of 50)

3. Please explain why you selected that format.

4. Please explain why you did not select the other format?

5. Which format made you think the most about the aspects?
   ____ Drag and Drop (18 of 50)
   ____ Write-In (19 of 50)
   ____ Both formats made me think about the aspects equally. (13 of 50)
6. Which format was easiest to use?
   ____ Drag and Drop (32 of 50)
   ____ Write-In (15 of 50)
   ____ Both formats were equally easy to use. (3 of 50)

7. Which format allowed you to complete the task the fastest?
   ____ Drag and Drop (36 of 50)
   ____ Write-In (7 of 50)
   ____ Both formats took about the same time. (7 of 50)
Appendix J

Modified System Usability Scale (SUS)

The following questions ask about your user experience while completing both the **drag and drop** and the **write-in** ranking formats. Your answers will help us determine which format is the most **usable**. Please place a checkmark in front of the response that most closely reflects your opinion.

The following 10 questions refer to only the **DRAG AND DROP** format.

1. I think that I would like to use the **drag and drop** format frequently.
   - ___ Strongly Agree
   - ___ Somewhat Agree
   - ___ Neither Agree nor Disagree
   - ___ Somewhat Disagree
   - ___ Strongly Disagree

2. I found the **drag and drop** format unnecessarily complex.
   - ___ Strongly Agree
   - ___ Somewhat Agree
   - ___ Neither Agree nor Disagree
   - ___ Somewhat Disagree
   - ___ Strongly Disagree

3. I thought the **drag and drop** format was easy to use.
   - ___ Strongly Agree
   - ___ Somewhat Agree
   - ___ Neither Agree nor Disagree
   - ___ Somewhat Disagree
   - ___ Strongly Disagree

4. I think that I would need the support of a technical person to be able to use the **drag and drop** format.
   - ___ Strongly Agree
   - ___ Somewhat Agree
   - ___ Neither Agree nor Disagree
   - ___ Somewhat Disagree
   - ___ Strongly Disagree
5. I found the various functions in the drag and drop format were well integrated.
   ___ Strongly Agree
   ___ Somewhat Agree
   ___ Neither Agree nor Disagree
   ___ Somewhat Disagree
   ___ Strongly Disagree

6. I thought there was too much inconsistency in the drag and drop format.
   ___ Strongly Agree
   ___ Somewhat Agree
   ___ Neither Agree nor Disagree
   ___ Somewhat Disagree
   ___ Strongly Disagree

7. I would imagine that most people would learn to use the drag and drop format very quickly.
   ___ Strongly Agree
   ___ Somewhat Agree
   ___ Neither Agree nor Disagree
   ___ Somewhat Disagree
   ___ Strongly Disagree

8. I found the drag and drop format very cumbersome to use.
   ___ Strongly Agree
   ___ Somewhat Agree
   ___ Neither Agree nor Disagree
   ___ Somewhat Disagree
   ___ Strongly Disagree

9. I felt confident using the drag and drop format.
   ___ Strongly Agree
   ___ Somewhat Agree
   ___ Neither Agree nor Disagree
   ___ Somewhat Disagree
   ___ Strongly Disagree

10. I needed to learn a lot of things before I could get going with the drag and drop format.
    ___ Strongly Agree
    ___ Somewhat Agree
    ___ Neither Agree nor Disagree
    ___ Somewhat Disagree
    ___ Strongly Disagree
The following 10 questions refer to only the **WRITE-IN** format.

1. **I think that I would like to use the write-in format frequently.**
   - ___ Strongly Agree
   - ___ Somewhat Agree
   - ___ Neither Agree nor Disagree
   - ___ Somewhat Disagree
   - ___ Strongly Disagree

2. **I found the write-in format unnecessarily complex.**
   - ___ Strongly Agree
   - ___ Somewhat Agree
   - ___ Neither Agree nor Disagree
   - ___ Somewhat Disagree
   - ___ Strongly Disagree

3. **I thought the write-in format was easy to use.**
   - ___ Strongly Agree
   - ___ Somewhat Agree
   - ___ Neither Agree nor Disagree
   - ___ Somewhat Disagree
   - ___ Strongly Disagree

4. **I think that I would need the support of a technical person to be able to use the write-in format.**
   - ___ Strongly Agree
   - ___ Somewhat Agree
   - ___ Neither Agree nor Disagree
   - ___ Somewhat Disagree
   - ___ Strongly Disagree

5. **I found the various functions in the write-in format were well integrated.**
   - ___ Strongly Agree
   - ___ Somewhat Agree
   - ___ Neither Agree nor Disagree
   - ___ Somewhat Disagree
   - ___ Strongly Disagree

6. **I thought there was too much inconsistency in the write-in format.**
   - ___ Strongly Agree
   - ___ Somewhat Agree
   - ___ Neither Agree nor Disagree
   - ___ Somewhat Disagree
   - ___ Strongly Disagree
7. I would imagine that most people would learn to use the write-in format very quickly.

___ Strongly Agree
___ Somewhat Agree
___ Neither Agree nor Disagree
___ Somewhat Disagree
___ Strongly Disagree

8. I found the write-in format very cumbersome to use.

___ Strongly Agree
___ Somewhat Agree
___ Neither Agree nor Disagree
___ Somewhat Disagree
___ Strongly Disagree

9. I felt confident using the write-in format.

___ Strongly Agree
___ Somewhat Agree
___ Neither Agree nor Disagree
___ Somewhat Disagree
___ Strongly Disagree

10. I needed to learn a lot of things before I could get going with the write-in format.

___ Strongly Agree
___ Somewhat Agree
___ Neither Agree nor Disagree
___ Somewhat Disagree
___ Strongly Disagree
Appendix K

System Usability Scale (SUS) Scoring Instructions

SUS yields a single number representing a composite measure of the overall usability of the system being studied. Note that scores for individual items are not meaningful on their own.

To calculate the SUS score, first sum the score contributions from each item. Each item's score contribution will range from 0 to 4. For items 1, 3, 5, 7, and 9 the score contribution is the scale position minus 1. For items 2, 4, 6, 8 and 10, the contribution is 5 minus the scale position. Multiply the sum of the scores by 2.5 to obtain the overall value of SUS. SUS scores have a range of 0 to 100.
Appendix L

Ratings Questionnaire

The following questions ask you to rate aspects based on their **degree of importance** to you while making your decision to attend the University of Dayton.

1. **Academic Reputation**
   - ____ Very Important
   - ____ Somewhat Important
   - ____ Slightly Important
   - ____ Slightly Unimportant
   - ____ Somewhat Unimportant
   - ____ Very Unimportant

2. **Availability of Majors of Importance to you**
   - ____ Very Important
   - ____ Somewhat Important
   - ____ Slightly Important
   - ____ Slightly Unimportant
   - ____ Somewhat Unimportant
   - ____ Very Unimportant

3. **Special Academic Programs (honors programs, etc.)**
   - ____ Very Important
   - ____ Somewhat Important
   - ____ Slightly Important
   - ____ Slightly Unimportant
   - ____ Somewhat Unimportant
   - ____ Very Unimportant

4. **Personal Attention to Students**
   - ____ Very Important
   - ____ Somewhat Important
   - ____ Slightly Important
   - ____ Slightly Unimportant
   - ____ Somewhat Unimportant
   - ____ Very Unimportant
5. Quality of Academic Facilities (Library, etc.)
   ___ Very Important
   ___ Somewhat Important
   ___ Slightly Important
   ___ Slightly Unimportant
   ___ Somewhat Unimportant
   ___ Very Unimportant

6. Availability of recreational facilities on campus
   ___ Very Important
   ___ Somewhat Important
   ___ Slightly Important
   ___ Slightly Unimportant
   ___ Somewhat Unimportant
   ___ Very Unimportant

7. Quality of on-campus housing
   ___ Very Important
   ___ Somewhat Important
   ___ Slightly Important
   ___ Slightly Unimportant
   ___ Somewhat Unimportant
   ___ Very Unimportant

8. Campus Surroundings (Neighborhood)
   ___ Very Important
   ___ Somewhat Important
   ___ Slightly Important
   ___ Slightly Unimportant
   ___ Somewhat Unimportant
   ___ Very Unimportant

9. Campus Attractiveness
   ___ Very Important
   ___ Somewhat Important
   ___ Slightly Important
   ___ Slightly Unimportant
   ___ Somewhat Unimportant
   ___ Very Unimportant
10. Cost (after scholarships and grants)
   ___ Very Important
   ___ Somewhat Important
   ___ Slightly Important
   ___ Slightly Unimportant
   ___ Somewhat Unimportant
   ___ Very Unimportant

11. Quality of social life
   ___ Very Important
   ___ Somewhat Important
   ___ Slightly Important
   ___ Slightly Unimportant
   ___ Somewhat Unimportant
   ___ Very Unimportant

12. Off campus cultural & recreational activities
   ___ Very Important
   ___ Somewhat Important
   ___ Slightly Important
   ___ Slightly Unimportant
   ___ Somewhat Unimportant
   ___ Very Unimportant

13. Opportunities for extracurricular activities
   ___ Very Important
   ___ Somewhat Important
   ___ Slightly Important
   ___ Slightly Unimportant
   ___ Somewhat Unimportant
   ___ Very Unimportant

14. Quality of majors of interest to you
   ___ Very Important
   ___ Somewhat Important
   ___ Slightly Important
   ___ Slightly Unimportant
   ___ Somewhat Unimportant
   ___ Very Unimportant
15. Reputation of college to potential employers
   ___ Very Important
   ___ Somewhat Important
   ___ Slightly Important
   ___ Slightly Unimportant
   ___ Somewhat Unimportant
   ___ Very Unimportant

16. Environment that stresses academic excellence
   ___ Very Important
   ___ Somewhat Important
   ___ Slightly Important
   ___ Slightly Unimportant
   ___ Somewhat Unimportant
   ___ Very Unimportant
Appendix M

Debriefing Form

Information about the Study
Thank you for participating in this study. Your participation has provided us with data on attitudes and the performances of people using two different ranking systems. During the study, you were presented with a drag-and-drop ranking system and a traditional ranking system. The drag-and-drop system is a new system for ranking items. The hypothesis is that respondents will be able to complete the drag-and-drop format quicker, with more ease, and with a better reflection of their beliefs than the traditional ranking format. At the end of the rankings process, your opinions of the two ranking formats were assessed using the SUS (system usability scale) as well as other preference questions. The answers you provided to the admission related questions will be provided to the Admissions Office in summary form, so you identity will be concealed from them. If you have any questions, please ask me now or contact me later (karthsst@notes.udayton.edu). You may find the references below of interest.

Please note:
- Kindly refrain from discussing this study with other so as not to bias future participants.

References


Assurance of Privacy
We are seeking general principles of behavior and are not evaluating you personally in any way. Your responses will be confidential, and a participant number in the data set along with other participants’ numbers will be the only way to identify your responses.
Contact Information
Students may contact William F. Moroney, Ph.D., william.moroney@notes.udayton.edu, in SJ 305, 937-229-2967 if they have questions or problems after the study. Students may also contact the chair of the Research Review and Ethics Committee, Charles E. Kimble, Ph.D., charles.kimble@notes.udayton.edu, in SJ 319, 937-229-2167.

Thank you for your time!