problem-solving, and facilitate self-directed learning and methods of self-assessment. However, this did not necessarily extend to the capacity of a user to facilitate the exploration of movement concepts. These results are documented in Figure 116. Dance Heuristic Evaluation Results. The questionnaire designed to obtain these results was developed in order to assess the utility of the high-level user functions for LabanAssist, and was created early on in the design process (see High-level User Functions in Chapter Seven, “Initial Design Requirements”).

<table>
<thead>
<tr>
<th>Labanotation: Expert Heuristic Questions</th>
<th>Participant A</th>
<th>Participant B</th>
</tr>
</thead>
<tbody>
<tr>
<td>The prototype tool ensures the accurate composition of Labanotation scores by allowing users to:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. Negotiate meaning</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>2. Construct understanding</td>
<td>✓</td>
<td>(✓)</td>
</tr>
<tr>
<td>3. Enable problem solving</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>The prototype tool facilitates:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. The exploration of movement concepts</td>
<td>✓</td>
<td>(✓)</td>
</tr>
<tr>
<td>2. Self-directed learning</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>3. Methods of self-assessment</td>
<td>✓</td>
<td>(✓)</td>
</tr>
</tbody>
</table>

![Figure 116](image)

Figure 116. Dance Heuristic Evaluation Results

Outcomes of the expert heuristic evaluation suggest that the proposed prototype application LabanAssist has the potential to meet a number of the key objectives that it is designed to address. Furthermore, obtaining feedback with regard to the issues surrounding the communication of complex information highlighted a significant concern for the development of interaction for LabanAssist. It centres on the level of complexity deemed necessary to be able to design a system for the greater ease of use of Labanotation, and one that includes the necessary level of complexity required for novice users to gain an appropriate understanding of the application of Labanotation to the documentation of movement. Therefore, the outcomes of this formative evaluation
provide a greater awareness to assist with how the novice testing of the proposed application can be designed to evaluate the subtle balance required to assist with a greater accessibility to Labanotation. The resolution of this concern is not only to assist with the use of Labanotation, but also to provide an understanding of the language in application to the documentation of movement.

Preliminary Product Testing

The creation of a mid-fidelity digital prototype for the further evaluation and development of LabanAssist has advanced the phase of product development to the next level. This development stemmed from an initial focus on the design of interface artefacts that took shape as a paper prototype. The successive progressions of the prototype transformed the design of the interaction and functional features that the interface for LabanAssist supported to a dynamic and interactive environment. Preliminary product testing of the prototype application in the early stage of its interactive development followed a “think aloud” protocol (Preece et al., 2002). This involved three male and three female students undertaking intermediate-to-advanced classes in Labanotation at OSU’s Dance Department.

A think aloud protocol requires potential end-users of a product to verbally articulate their understanding of the system that the product supports, while interacting with the functionality it offers (Someren, Barnard, and Sandberg, 1994). This takes place simultaneously as end-users of the system work towards completing a particular task or goal. For the purpose of this evaluation, six different tasks were asked of the participants. This was done in order to assess the misconceptions or disconnect between the mutual goals of the system and its end-users (see Figures 117–119: Preliminary Product Evaluation Tasks). The participants were asked to verbalise their thoughts during this process of evaluation. A sound-recording device was employed to capture the participant’s verbal explanations of what they were thinking aloud. This was while they were working with the mid-fidelity prototype. I also observed the interactions the participants performed.

By capturing this information, an end-user’s conceptual understanding of the functionality a system provides may be assessed with regard to a user’s expectations of
Researchers: Dr Deirdre Barron (SUT), Sheila Marion (OSU) & Natalie Ebenreuter (SUT)
Faculty of Design, Swinburne University of Technology
The Transference of Dance Information through Interface Design

Preliminary Usability Tasks

<table>
<thead>
<tr>
<th>Tasks, Goals &amp; Instructions</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Task 01. Application Startup</strong></td>
</tr>
<tr>
<td>In this task we will start LabanAssist and create a new document.</td>
</tr>
</tbody>
</table>

Instructions:
Open the application LabanAssist in the most basic level available and create a new document.

| **Task 02. New Score Setup**  |
| In this task we will setup a basic Laban score.  |

Instructions:
Setup a new score to have:

1. A single standard staff with a starting position and a line ending the movement.

2. Set the measure of the staff to have a 3/4 time signature. We would like to notate two measures of movement and to view the timing of the measure as numbers.

3. We do not want to include a floor plan or glossary in the document set up. The layout should be for a single standard staff that is left aligned. Please add your credit information.

* **Feedback:** Please answer questions 1 - 3

---

**Figure 117.** Preliminary Product Evaluation Task 1
Tasks, Goals & Instructions

**Task 03. Explore the Interface**
In this task we will become more familiar with the interface and features of LabanAssist.

Instructions:
Click on any icons, buttons, features and menus of interest. Also try moving the interface items around.

* **Feedback**: Please answer questions 4 - 9

**Task 04. Document Movement**
In this task we will document a simple starting position.

Instructions:
Following the example below, please use the Movement Editor to notate this starting position.

* **Feedback**: Please answer questions 10 - 15

**Figure 118.** Preliminary Product Evaluation Task 2
## Tasks, Goals & Instructions

### Task 05. Symbol Inspector
In this task we will identify the meaning of a specific Laban symbol, access information that will further our understanding of its properties and edit our starting position.

**Instructions:**

1. Select the first black square symbol in the bottom left corner of the score (the symbol for the left arm placed low). Then have a look at the information in the Symbol Inspector under the tab called ‘Symbol’. Have a look at the attributes listed and the Laban Library to see if this information helps you to understand what this symbol means and how it can be used.

2. Using the resources in the Symbol Inspector please change the starting position so that only the right arm is placed low.

* **Feedback:** Please answer questions 16 & 17

---

### Task 06. Score Playback
In this task we will view the movement described within a Laban score as animated movement.

**Instructions:**

Now that we have a complete measure of notated movement, make use of the various controls provided in the Motion Viewer and Score Editor to view the Laban symbols on the score as animated movement.

* **Feedback:** Please answer questions 18 - 22

---

**Figure 119.** Preliminary Product Evaluation Task 3
the system and the interactive choices he or she makes (Preece et al., 2002). This method of formative evaluation seeks to determine, in this case, if the proposed system affords its end-users the interaction they require to document movement successfully (Gibson, 1979). The evaluation took place in a working environment similar to that of an office setting, where information technology systems and standard desktop computers are used on a daily basis.

The preliminary usability test did not start with a demonstration or introduction to the features of the prototype application. The testing procedure began with the task of creating a new document, and proceeded with the second task of setting up a basic Labanotation score. The tasks throughout a majority of the preliminary product test were accompanied by a set of explicit instructions. These instructions were designed to assist participants to identify the elements they needed to engage with in order to complete each task. The third task of the evaluation was to explore the interface features of LabanAssist as a way to develop an individual understanding and firsthand experience of the systems functionality. Because of their training, a characteristic of many dance students is their ability to quickly identify and imitate action and movement with great skill and precision. Rather than risk having participants in this research imitate a number of quickly learned interactions from a formal introduction to the system, a self-exploratory approach was taken to better acquaint users of the system with the knowledge of its boundaries. Following this, participants were asked to document a simple starting position using the Movement Editor. They were then asked to use the Symbol Inspector to identify the attributes of Labanotation symbols on the score, and to modify the starting position they had previously documented. Using the functionality of the Score Editor and the Motion Viewer, participants were asked in the final task to visualise and review of the movement they had created.

In between each individual task, participants were also asked to answer a number of questions that were relevant to their immediate experience of interacting with the prototype application by completing a preliminary product evaluation questionnaire (see Figures 120–122: Preliminary Product Evaluation Questionnaire). The design of the preliminary product evaluation questionnaire evolved out of the heuristic evaluation questionnaire used in the previous evaluation. This was done as a means to further
Preliminary Usability Testing Questions

Upon the completion of specific tasks, the following line of questioning is used to assess if you experienced any specific benefits or difficulties with the interface and interaction design of the prototype application.

Please select one of the following, strongly agree, agree, neutral, disagree or strongly disagree to rate your response to the following.

<table>
<thead>
<tr>
<th>Question</th>
<th>strongly agree</th>
<th>agree</th>
<th>neutral</th>
<th>disagree</th>
<th>strongly disagree</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. The structure of the score set up let me change between screens of information to specify, change and finalise my document properties.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. The preview window to the right of each section of the score set up helped me to see the choices I was making.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. Error messages were helpful in assisting me when I got stuck.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. I could find my way around the interface.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. I understand the terms used in the interface.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6. I understand what the icons in the interface represent.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7. The task bar gave me an understanding of what the application could let me to do.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8. I could reposition the interface windows to suit my style of working.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9. The option to change the rulers and guides in the Score Editor is useful for showing different divisions of the staff.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Figure 120.** Preliminary Product Evaluation Questionnaire 1
Preliminary Usability Testing Questions

Please select one of the following, strongly agree, agree, neutral, disagree or strongly disagree to rate your response to the following.

<table>
<thead>
<tr>
<th>Question</th>
<th>strongly agree</th>
<th>agree</th>
<th>neutral</th>
<th>disagree</th>
<th>strongly disagree</th>
</tr>
</thead>
<tbody>
<tr>
<td>10. The options in the Movement Editor provide a straightforward description of movement.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>11. The structure of the Movement Editor helped me to notate Labanotation symbols on the scores.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>12. The structure of the Movement Editor provides a logical way of notating movement.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>13. The structure of the Movement Editor let me change between screens of information to specify, change and finalise my characteristics of movement.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>14. The visual representation of Laban symbols in the preview window helped me to identify their shape (against my description of movement).</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>15. The visual representation of Laban symbols in the preview window helped me to gain an understanding of their meaning (against my description of movement).</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>16. The symbol inspector provides useful information about the Laban symbols on a score.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>17. It was easy to edit Labanotation symbols once they had been added to the score.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Figure 121.** Preliminary Product Evaluation Questionnaire 2
Preliminary Usability Testing Questions

Please select one of the following, strongly agree, agree, neutral, disagree or strongly disagree to rate your response to the following.

<table>
<thead>
<tr>
<th>Question</th>
<th>strongly agree</th>
<th>agree</th>
<th>neutral</th>
<th>disagree</th>
<th>strongly disagree</th>
</tr>
</thead>
<tbody>
<tr>
<td>18. The layout of the screen made the comparison between the Labanotation score and the proposed 3d representation of movement clear and easy to interpret.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>19. Visually comparing Labanotation symbols beside the proposed 3d representation of movement helps me to identify and clarify the movements the symbols stand for.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>19. The dialogue boxes are user friendly.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>20. The structure of the dialogue boxes helped me to remember the process required to compose movement.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>21. The error messages are helpful.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>22. This application is useful.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Thank-you for your participation

**Figure 122.** Preliminary Product Evaluation Questionnaire 3
assess the effectiveness of the interface; its capacity to communicate the utility of its functionality; and its ability to assist the user to visualise movement for use and understanding (Shneiderman and Plaisant, 2005). A five-point Likert scale was used to assess individual participant responses. Participants were therefore asked to strongly agree, agree, remain neutral, disagree, or strongly disagree with the questions asked. The questions for the preliminary product evaluation questionnaire, listed below, were designed specifically to identify particular uses of functionality and interactive pathways that assist end-users of the system to achieve their goals. These goals are identified in relation to the various interface artefacts that LabanAssist embraces to form a unifying system of interaction.

The following questions illustrate their association to the functionality and interface artefacts LabanAssist offers:

Application Start and New Score Setup:

1. The structure of the score setup let me change between screens of information to specify, change, and finalise my document properties.
2. The preview window to the right of each section of the score setup helped me to see the choices I was making.
3. Error messages were helpful in assisting me when I got stuck.

The Interface:

4. I could find my way around the interface.
5. I understand the terms used in the interface.
6. I understand what the icons in the interface represent.
7. The task bar gave me an understanding of what the application could let me do.
8. I could reposition the interface windows to suit my style of working.
9. The option to change the rulers and guides in the Score Editor is useful for showing different divisions of the staff.

Describe and Document Movement: Movement Editor

10. The options in the Movement Editor provide a straightforward description of movement.
11. The structure of the Movement Editor helped me to notate Labanotation symbols on the scores.

12. The structure of the Movement Editor provides a logical way of notating movement.

13. The structure of the Movement Editor let me change between screens of information to specify, change, and finalise my characteristics of movement.

14. The visual representation of Laban symbols in the preview window helped me to identify their shape (against my description of movement).

15. The visual representation of Laban symbols in the preview window helped me to gain an understanding of their meaning (against my description of movement).

Identify and Modify Movement: Symbol Inspector and Score Editor

16. The Symbol Inspector provides useful information about the Laban symbols on a score.

17. It was easy to edit Labanotation symbols once they had been added to the score.

Visualise and Understand Movement: Motion Viewer and Score Editor

18. The layout of the screen made the comparison between the Labanotation score and the proposed 3d representation of movement clear and easy to interpret.

19. Visually comparing Labanotation symbols beside the proposed 3d representation of movement helps me to identify and clarify the movements the symbols stand for.

In General:

20. The dialogue boxes are user-friendly.

21. The structure of the dialogue boxes helped me to remember the process required to compose movement.

22. The error messages are helpful.

23. This application is useful.

Results from preliminary product usability tests indicate that students “strongly agree” and “agree” that the prototype application LabanAssist facilitates the goals they were asked to perform and evaluate (see Figure 123. Preliminary Product Evaluation Results). Observations I made and comments made by participants during the think
Students **strongly agree** that the structure of the score set up let them change between screens of information to specify, change and finalise my document properties.

Students **agree** that the preview window to the right of each section of the score set up helped them to see the choices they were making.

Students **agree** that error messages were helpful in assisting them when they got stuck.

Students **agree** that they could find their way around the interface.

Students **strongly agree** that they could understand the terms used in the interface.

Students **strongly agree** that they could understand what the icons in the interface represent.

Students **strongly agree** that the task bar gave them an understanding of what the application could let them do.

Students **agree** that they could reposition the interface windows to suit their style of working.

Students **agree** that the option to change the rulers and guides in the Score Editor is useful for showing different divisions of the staff.

Students **agree** that the options in the Movement Editor provide a straightforward description of movement.

Students **agree** that the structure of the Movement Editor helped them to notate Labanotation symbols on the scores.

Students **agree** that the structure of the Movement Editor provides a logical way of notating movement.

Students **agree** that the structure of the Movement Editor let them change between screens of information to specify, change and finalise the characteristics of movement.

Students **strongly agree** that the visual representation of Laban symbols in the preview window helped them to identify their shape (against their description of movement).

Students **agree** that the visual representation of Laban symbols in the preview window helped them to gain an understanding of their meaning (against their description of movement).

Students **strongly agree** that the symbol inspector provides useful information about the Laban symbols on a score.

Students **agree** that it was easy to edit Labanotation symbols once they had been added to the score.

Students **agree** that the layout of the screen made the comparison between the Labanotation score and the proposed 3d representation of movement clear and easy to interpret.

Students **strongly agree** that visually comparing Labanotation symbols beside the proposed 3d representation of movement helps them to identify and clarify the movements the symbols stand for.

Students **strongly agree** that the dialogue boxes are user friendly.

Students **agree** that the structure of the dialogue boxes helped them to remember the process required to compose movement.

Students **strongly agree** that the error messages are helpful.

Students **strongly agree** that this application is useful.

**Figure 123.** Preliminary Product Evaluation Results
aloud protocol further enhanced the ongoing development of the prototype application. It enabled diverse ways of thinking and interaction to be identified as pertaining to a number of participants who were new to the experience of working with a system designed to simplify the complex process of documenting movement using Labanotation symbols.

Careful examination of user observations and judgments voiced by participants during the think aloud protocol led to the increased variety offered in the system of interaction for LabanAssist. These additions were designed and developed in the subsequent prototype application as a result of user feedback, and the diversity in which participants actively engaged in the task of describing movement, during the preliminary product evaluation. This in turn led to the introduction of an enhanced process for the composition of movement through the utility of the Movement Editor discussed further below.

The formative testing and development of LabanAssist as a mid-fidelity prototype also provided a practical indication as to the extent in which the functionality of the prototype should be programmed for its summative evaluation. It illustrated the differences between the problems arising from an inadequate understanding of a system’s utility and its subsequent misuse, and a user’s unfamiliarity with a new system for interaction. Therefore, the interaction design for a number of significant interface artefacts were developed to a level considered suitable for the purposes of the final product evaluation, and necessary to support a variety of user interactions.

**Iterative Development**

The iterative development of LabanAssist took shape as a high-level prototype application in response to early user consultation, collaboration and methods of evaluation. This led to the development of an enhanced process for the composition of movement as a result of improvements made to the utility of the Movement Editor. In the following research I illustrate the iterative development of the prototype through the design process. I give emphasis to the design of the Movement Editor because it underwent an extensive process of revision, reconsideration and further development. This is because the purpose of the Movement Editor is to unify a system of interaction
that makes the documentation of Labanotation scores possible. The functionality it provides extends to the use of a number of different interface artifacts and contributes to a dynamic and integrated system of interaction. The subsequent product enhancements, listed below, stem from end-user and expert feedback acquired during the early evaluation of the artifacts initial conceptual design. I discuss these changes below in relation to specific user responses and describe the rationale behind the changes made to the functional elements of LabanAssist.

Outcomes of the Dance Heuristic Evaluation Workshop Discussions involving Labnotation experts and preliminary product testing with potential end-users of the prototype application prompted the redesign of the Movement Editor. Careful consideration was, therefore, given to the combinations of fundamental movement qualities represented in the interface of the Movement Editor. This was with respect to the categorisation of movement information, the structural arrangement of the Movement Editor and its overall functionality. The review of these elements was designed to better assist the conceptual understanding and practical application of Labanotation to movement. Changes made to the categorical and structural organisation of the Movement Editor are illustrated in Figures 124. The Movement Editor, conceptual design and 125. The Movement Editor, design iteration. This is where body part (see Figure 124a. The Movement Editor, conceptual design) is substituted for supports (see Figure 125a. The Movement Editor, design iteration) and style, (see Figure 124b. The Movement Editor, conceptual design) now appears as gestures (see Figure 125b. The Movement Editor, design iteration).

The above-mentioned changes were made in order to better align the process of documenting movement in a system that includes the level of complexity necessary to assist novice users to gain a deep conceptual understanding of the process of composing Labanotation scores. While the terminology of body part and style may have originally appealed to a novice understanding of the language, the terms themselves do not adequately represent the practice of Labanotation. By over simplifying the terminology used in the process of notating movement the potential to facilitate the transition of user knowledge to a complex understanding of the language, is greatly reduced. It was, therefore, suggested by Labanotation experts that introducing novice users to the conceptual language that Labanotation uses to describe movement, at the outset, would
be beneficial to a student’s progressive development and understanding of the language (see Figure 110. Dance Heuristic Evaluation Workshop Discussion). In this way students may also learn to follow a structured methodology for the process of documenting movement that correlates directly to Laban theory.

Since the outcomes of the Dance Heuristic Evaluation Workshop Discussion were acknowledged in Figure 110, a repetition tab has been added to the Movement Editor (see Figure 126. Repetition Tab). The functional design of the repetition tab is in part a response to the additional concerns raised by Labanotation experts surrounding the