long-term efficiency of the Movement Editor (see Figure 115. Dance Heuristic Evaluation Workshop Discussion). The value of the repetition tab is that it enables end-users of LabanAssist to document repeatable sequences of movements. This is achieved through the selection of distinct measures of movement, which can be repeated in either identical or alternate succession within a score. End-users may also modify specific elements of movement sequences or steps to be repeated in a variety of different ways. In addition to this a movement library (see Figure 127. Movement Library) was also designed to enable end-users of LabanAssist to create, record and replicate basic and
common elements of any type of repetitive movement sequences on a score. The proposed movement library was, however, not included in the testing of the prototype application designed for novice users of Labanotation. This is because of the level of complexity required by end-users of LabanAssist to fully understand and utilise the functionality of the movement library. Nevertheless, it is envisaged that the movement library will find application in the intermediate and advanced levels of LabanAssist as discussed in Chapter Eight, “Relationship to the User”.

The extension of the Movement Editor’s functionality to enable a description of movement to span a complete beat of movement, as opposed to only one or two elements at any given time is significant to the efficient composition of movement. The inclusion of this functionality allows end-users of LabanAssist greater flexibility and effectiveness in the documentation of movement as Labanotation scores (see Figure 128. Dual Notation Process). Figure 128a. Dual Notation Process illustrates a previous version of the Movement Editor in which it is only possible to describe and notate a single Labanotation symbol on a score, at any given time. However, in situations where the movement elements of a single symbol can also be described on the alternate side of the body, it is possible to document both single and similar notation symbols in a beat of movement. Labanotation symbols that correspond to movement being described during the process of documenting movement are highlighted in red, and are visually illustrated within the Laban score preview window on the left hand side of the Movement Editor’s interface.

![Figure 128. Dual Notation Process](image-url)
In an attempt to alleviate the overwhelming task of composing Labanotation scores while addressing the limitations of a single and similar symbol notation process voiced by participants of the think aloud protocol, the utility of the Movement Editor was extended. This led to the increased capacity of the Movement Editor to facilitate the documentation of all possible descriptions of movement within a single beat of a score. This is illustrated in Figure 128b. Dual Notation Process in which previously described supports are dulled to grey, while the symbols currently being described and added in the gestures tab are highlighted in red. Again, the notion of similar movement elements that can be symbolically described on both the left and right side of the body may be documented at the same time. Different elements of a movements characteristics found in the orientation and repetition tabs may also be notated in a beat of movement before its description is applied to the score. This range of interaction developed in the Movement Editor was also extended to include the various ways in which end-users of the prototype could manipulate and amend movement described as Labanotation scores. This is made possible through the improved functionality of the Score Editor and Symbol Inspector that enables users to edit, delete, or modify Labanotation symbols already positioned on a score.

For the purpose of this research a variety of different participatory design processes that lend themselves to collaborative and early evaluative techniques were used to facilitate the development of LabanAssist as a high-level prototype application. By illustrating the iterative development of the Movement Editor that was in response to novice and expert feedback, I argue that it is possible to create design outcomes that have a greater potential to supply end-users of a product with a useful and usable means of reaching a desired goal. The benefit of this research is that it demonstrates the outcomes of collaborative design processes used to obtain user feedback. This feedback was used to assist the practical and iterative development of interface artifacts that were redesigned to better support a variety of user interactions for further evaluation.

**Product Evaluation**

A final product usability test for the evaluation of the high-level prototype application LabanAssist was designed to assess its functional and operational aspects. The development and design of a high-level prototype enables similar materials and levels
of functionality proposed for the creation of a design product to be tested and evaluated in a prototype form (Preece et al., 2002). The product evaluation of LabanAssist included the prototype’s overall capacity to facilitate useful, usable, and desirable interaction in conjunction with its capacity to communicate complex arbitrary information effectively through the design, and subsequent application of an interface. The product usability test was also designed to leverage a user’s ability to identify, interpret, and navigate the functionality LabanAssist offers in order to compose movement as Labanotation scores.

Once again, the product testing procedures involved three male and three female students undertaking intermediate and advanced Labanotation courses at OSU’s Dance Department. While this represents a small range in the number of participants for a product evaluation, a number any greater than five participants does not significantly increase the number of usability problems found (Nielsen and Mack, 1994; Snyder, 2003). The evaluation took place in a quiet office environment where information software systems and desktop computers are used to access, create, and record information.

The product usability test consisted of three key tasks. The facilitator of the evaluation performed the first task, which was designed to introduce the participants to the range of functionality that LabanAssist offers as a high-level prototype application. This included an overview of the product features that facilitate the initial setup of a score, and the subsequent creation and documentation of movement as a Labanotation score. The second task required participants to set up a basic Labanotation score that met a specific number of requirements. In addition to this, participants were asked to use the Movement Editor to notate a previously composed measure of movement. To achieve this, participants were supplied with a standard Labanotation score as reference material to assist them with the completion of this task. The third and final task required participants to make use of the Symbol Inspector to identify, delete, modify, and confirm the movement they had composed and amended (see Figures 129–131: Product Evaluation Tasks). Following the practical evaluation of the prototype application, the participants completed a Product Evaluation Questionnaire, which concluded the product evaluation (see Figures 132–136: Product Evaluation Questionnaire). The
Final Usability Tasks

<table>
<thead>
<tr>
<th>Tasks, Goals &amp; Instructions</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Task 01. Application Overview</strong></td>
</tr>
<tr>
<td>In this task we will become more familiar with the interface features and functionality of LabanAssist.</td>
</tr>
</tbody>
</table>

The introduction highlights:

1. **Score Set Up Properties**
   - need to check all properties to complete
   - the task bar at the main interface enables you to modify your existing score settings
   - visual guides, score numbers and staff properties can be modified in the Score Editor

2. **How to use the Movement Editor**
   - single symbol editing (set the measure option for each symbol and look for the blue apply button to add your movement descriptions)
   - whole beat editing (set the measure option for the beat and look for the blue apply button in each section before making your final submission)
   - show the restrictions in the drop down menus (you can only select a level once the correct direction has been selected. Selecting none at the body part level will clear the direction and level menus)

3. **How to use the Movement Editor and the Score Editor**
   - how to review notation while documenting movement
   - reposition the interface windows

4. **How to use the Symbol inspector**
   - function of the symbol tab
   - function of the measure tab
   - 3 ways to edit existing symbols (delete, edit by change & edit by de-selection)

**Figure 129.** Product Evaluation Task 1
### Tasks, Goals & Instructions

#### Task 02. Create a Labanotation Score
In this task we will notate one measure of movement.

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.

4. Following the example provided, please use the Movement Editor to notate this measure of movement.

#### Task 03. Symbol Recognition & Editing
In this task we will identify the meaning of specific Laban symbols, access information that will further our understanding of their properties and edit our notation.

Instructions:
1. Please select the left forward middle arm gesture in the first beat of movement and using the resources in the Symbol Inspector delete this symbol.

2. Then select the symbol for the left arm place low in the starting position and take a look at the information in the Symbol Inspector under the tabs called 'Symbol' and 'Measure'. Have a look at the attributes listed and the Laban Library to see if this information helps you to identify and understand what this symbol is, what it represents and how it can be used.

3. Using the resources in the Symbol Inspector please change this symbol to a forward middle arm gesture that is in the first beat of the first measure. Please select the newly created symbol and view the information within the 'Symbol' and 'Measure' tabs in the Symbol Inspector to verify the movement you have described to gain a contextual understanding of the movement you have modified.

*Feedback:* Please complete the Usability Testing forms

---

**Figure 130.** Product Evaluation Task 2
Figure 131. Product Evaluation Task 3
Background Information
Please select the most appropriate for the following.

1. Age Range:
   - □ 18-22
   - □ 22-26
   - □ 26-30
   - □ Other (Please specify)________________

2. Gender:
   - □ Male
   - □ Female

3. Knowledge of Labanotation:
   - □ Novice
   - □ Elementary
   - □ Intermediate
   - □ Advanced

4. Experience with computers:
   - □ Novice
   - □ Elementary
   - □ Intermediate
   - □ Advanced

5. Experience with dance notation applications:
   - □ Novice
   - □ Elementary
   - □ Intermediate
   - □ Advanced

6. Knowledge of operating systems:
   - □ Macintosh
   - □ Windows
   - □ Other (Please specify)________________

---

Figure 132. Product Evaluation Questionnaire 1
Feedback survey for persons participating in usability testing

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>Questions</th>
<th>strongly agree</th>
<th>agree</th>
<th>neutral</th>
<th>disagree</th>
<th>strongly disagree</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. It is easy to learn how to use the system.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. I understand the logic of the system.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. I was able to recover easily from errors.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. I felt in control of the interaction with the system.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. I felt the structure of the system guided me through the process of creating a Labanotation score.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6. The visual representation of movement positions and Laban symbols in the system interface helps me to make decisions about the movement I was describing.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7. The interface provided me with visual references and information that enhanced my understanding of Labanotation.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8. Through continued use of the system my understanding of Labanotation would improve.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9. The application is a valuable tool to compose, edit, review and verify Labanotation scores.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10. I would use this system.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Figure 133.** Product Evaluation Questionnaire 2
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

Feedback survey for persons participating in usability testing

General Questions
Please select □ Y (yes) or □ N (no) for the following.

1. The prototype LabanAssist enables the correct composition of Labanotation scores by allowing users to:
   1. Recognise the meaning of symbols □ Y or □ N
   2. Associate symbols to movement □ Y or □ N
   3. Enable problem solving □ Y or □ N

2. The prototype facilitates:
   1. The exploration of movement concepts □ Y or □ N
   2. Self-directed learning □ Y or □ N
   3. Methods of self-assessment □ Y or □ N

3. Comments
The overall design, language, functionality or usability of prototype A could be improved by:

_________________________________________________________________________________

_________________________________________________________________________________

_________________________________________________________________________________

_________________________________________________________________________________

Figure 134. Product Evaluation Questionnaire 3
Figure 135. Product Evaluation Questionnaire 4

Feedback survey for persons participating in usability testing

<table>
<thead>
<tr>
<th>4. In general I found the system to be:</th>
<th>+3</th>
<th>+2</th>
<th>+1</th>
<th>0</th>
<th>-1</th>
<th>-2</th>
<th>-3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Exciting</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Appealing</td>
<td>+3</td>
<td>+2</td>
<td>+1</td>
<td>0</td>
<td>-1</td>
<td>-2</td>
<td>-3</td>
</tr>
<tr>
<td>Satisfying</td>
<td>+3</td>
<td>+2</td>
<td>+1</td>
<td>0</td>
<td>-1</td>
<td>-2</td>
<td>-3</td>
</tr>
<tr>
<td>Encouraging</td>
<td>+3</td>
<td>+2</td>
<td>+1</td>
<td>0</td>
<td>-1</td>
<td>-2</td>
<td>-3</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>5. I found the functionality of the system to be:</th>
<th>+3</th>
<th>+2</th>
<th>+1</th>
<th>0</th>
<th>-1</th>
<th>-2</th>
<th>-3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Informative</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Valuable</td>
<td>+3</td>
<td>+2</td>
<td>+1</td>
<td>0</td>
<td>-1</td>
<td>-2</td>
<td>-3</td>
</tr>
<tr>
<td>Useful</td>
<td>+3</td>
<td>+2</td>
<td>+1</td>
<td>0</td>
<td>-1</td>
<td>-2</td>
<td>-3</td>
</tr>
<tr>
<td>Instructive</td>
<td>+3</td>
<td>+2</td>
<td>+1</td>
<td>0</td>
<td>-1</td>
<td>-2</td>
<td>-3</td>
</tr>
</tbody>
</table>
Feedback survey for persons participating in usability testing

Please circle one of the following, +3, +2, +1, 0, -1, -2, -3 to rate your response to the following.

6. I found the interface:

<table>
<thead>
<tr>
<th>Quality</th>
<th>+3</th>
<th>+2</th>
<th>+1</th>
<th>0</th>
<th>-1</th>
<th>-2</th>
<th>-3</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Reliable</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Unreliable</td>
</tr>
<tr>
<td>Clear</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Confusing</td>
</tr>
<tr>
<td>User Friendly</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Difficult to use</td>
</tr>
<tr>
<td>Efficient</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Ineffective</td>
</tr>
<tr>
<td>Flexible</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Restrictive</td>
</tr>
</tbody>
</table>

**Figure 136.** Product Evaluation Questionnaire 5
design of the product evaluation questionnaire was the result of the questions developed for both the heuristic evaluation and preliminary product evaluation questionnaires.

Quantitative results from the product evaluation suggest that one hundred percent of students questioned found that the prototype LabanAssist enabled the correct composition of Labanotation scores by allowing them to: (1) recognise the meaning of symbols; (2) associate symbols to movement; and, (3) enabled problem-solving. All of students questioned found that the prototype LabanAssist facilitated: (1) the exploration of movement concepts; and, (2) self-directed learning. Eighty-three percent of the students also found the prototype facilitated methods of self-assessment (see Figure 137. Product Evaluation Results, Quantitative Results).

Research findings evaluated using a five-point Likert scale tell us that students strongly agree that the structure of the system guided them through the process of creating a Labanotation score. Students also strongly agree that the application is a valuable tool for the composing, editing, reviewing, and verifying of Labanotation scores; and one that they would use in the future (see Figure 137. Product Evaluation Results, Likert Scale Results). Results from a line of questioning measured by a semantic differential scale (Krippendorff, 2006; Shneiderman and Plaisant, 2005) suggest that the students found the prototype to be exciting, appealing, satisfying, and encouraging. They also found the functionality of the system to be informative, valuable, useful, and instructive. The students’ impressions of the interface design of LabanAssist were that they considered it to be reliable, clear, user-friendly, efficient, and flexible (see Figure 138. Semantic Differential Results).

Outcomes of this research suggest that an operational structure for the process of composing Labanotation scores provides end-users of the system LabanAssist to create Labanotation scores with greater syntactic and grammatical precision. Furthermore, Sheila Marion, Associate Professor and Director of the Dance Notation Bureau Extension, critically examined and approved the prototype application for its pedagogy and suitability for learners of Labanotation (see Figure 139. Expert Recommendation, and Appendix A1: LabanAssist).
Quantitative Results

<table>
<thead>
<tr>
<th>Percentage</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>100%</td>
<td>of students questioned found the prototype LabanAssist enabled the correct composition of Labanotation scores by allowing them to recognize the meaning of symbols.</td>
</tr>
<tr>
<td>100%</td>
<td>of students questioned found the prototype LabanAssist enabled the correct composition of Labanotation scores by allowing them to associate symbols to movement.</td>
</tr>
<tr>
<td>100%</td>
<td>of students questioned found the prototype LabanAssist enabled the correct composition of Labanotation scores by allowing them to enable problem solving.</td>
</tr>
<tr>
<td>100%</td>
<td>of students questioned found the prototype facilitates the exploration of movement concepts.</td>
</tr>
<tr>
<td>100%</td>
<td>of students questioned found the prototype facilitates self-directed learning.</td>
</tr>
<tr>
<td>83%</td>
<td>of students questioned found the prototype facilitates methods of self-assessment.</td>
</tr>
</tbody>
</table>

Likert Scale Results

Students **agree** that it is easy to learn how to use the system.

Students **agree** that they understand the logic of the system.

Students **agree** that they are able to recover easily from errors.

Students **agree** that they feel in control of the interaction with the system.

Students **agree** that the visual representation of movement positions and Laban symbols in the system interface helps them to make decisions about the movement they are describing.

Students **agree** that through continued use of the system their understanding of Labanotation would improve.

Students **agree** that the interface provides them with visual references and information that enhance their understanding of Labanotation.

Students **strongly agree** that they feel the structure of the system guides them through the process of creating a Labanotation score.

Students **strongly agree** that the application is a valuable tool to compose, edit, review and verify Labanotation scores.

Students **strongly agree** that they would use this system (LabanAssist).

**Figure 137. Product Evaluation Results**
In general students found the system to be:

<table>
<thead>
<tr>
<th>Feature</th>
<th>+3</th>
<th>+2</th>
<th>+1</th>
<th>0</th>
<th>-1</th>
<th>-2</th>
<th>-3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Exciting</td>
<td>3</td>
<td>2</td>
<td>1</td>
<td>0</td>
<td>-1</td>
<td>-2</td>
<td>-3</td>
</tr>
<tr>
<td>Appealing</td>
<td>3</td>
<td>2</td>
<td>1</td>
<td>0</td>
<td>-1</td>
<td>-2</td>
<td>-3</td>
</tr>
<tr>
<td>Satisfying</td>
<td>3</td>
<td>2</td>
<td>1</td>
<td>0</td>
<td>-1</td>
<td>-2</td>
<td>-3</td>
</tr>
<tr>
<td>Encouraging</td>
<td>3</td>
<td>2</td>
<td>1</td>
<td>0</td>
<td>-1</td>
<td>-2</td>
<td>-3</td>
</tr>
</tbody>
</table>

In general students found the functionality of the system to be:

<table>
<thead>
<tr>
<th>Feature</th>
<th>+3</th>
<th>+2</th>
<th>+1</th>
<th>0</th>
<th>-1</th>
<th>-2</th>
<th>-3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Informatiue</td>
<td>3</td>
<td>2</td>
<td>1</td>
<td>0</td>
<td>-1</td>
<td>-2</td>
<td>-3</td>
</tr>
<tr>
<td>Valuable</td>
<td>3</td>
<td>2</td>
<td>1</td>
<td>0</td>
<td>-1</td>
<td>-2</td>
<td>-3</td>
</tr>
<tr>
<td>Useful</td>
<td>3</td>
<td>2</td>
<td>1</td>
<td>0</td>
<td>-1</td>
<td>-2</td>
<td>-3</td>
</tr>
<tr>
<td>Instructive</td>
<td>3</td>
<td>2</td>
<td>1</td>
<td>0</td>
<td>-1</td>
<td>-2</td>
<td>-3</td>
</tr>
</tbody>
</table>

In general students found the interface:

<table>
<thead>
<tr>
<th>Feature</th>
<th>+3</th>
<th>+2</th>
<th>+1</th>
<th>0</th>
<th>-1</th>
<th>-2</th>
<th>-3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reliable</td>
<td>3</td>
<td>2</td>
<td>1</td>
<td>0</td>
<td>-1</td>
<td>-2</td>
<td>-3</td>
</tr>
<tr>
<td>Clear</td>
<td>3</td>
<td>2</td>
<td>1</td>
<td>0</td>
<td>-1</td>
<td>-2</td>
<td>-3</td>
</tr>
<tr>
<td>User Friendly</td>
<td>3</td>
<td>2</td>
<td>1</td>
<td>0</td>
<td>-1</td>
<td>-2</td>
<td>-3</td>
</tr>
<tr>
<td>Efficient</td>
<td>3</td>
<td>2</td>
<td>1</td>
<td>0</td>
<td>-1</td>
<td>-2</td>
<td>-3</td>
</tr>
<tr>
<td>Flexible</td>
<td>3</td>
<td>2</td>
<td>1</td>
<td>0</td>
<td>-1</td>
<td>-2</td>
<td>-3</td>
</tr>
</tbody>
</table>

**Figure 138.** Semantic Differential Results
June 1, 2007

Subject: Critical examination of the prototype application LabanAssist

To whom it may concern:

I confirm that I have critically examined and approved the prototype application LabanAssist for its pedagogy and suitability for learners of Labanotation.

The potential for this program offers members of the dance community a wonderful way to simultaneously learn and write the language of Labanotation. LabanAssist is easy to follow and more importantly results in a well presented, error free score that can be visualized as human figure animation.

The overall look of the prototype application is straightforward, uncluttered, calming, and very clear. The further implementation of LabanAssist as a fully functioning software application would have a significant impact on the field.

Sincerely,

Sheila Marion, Ph.D.
Associate Professor and Director
Dance Notation Bureau Extension
Department of Dance
The Ohio State University

Figure 139. Expert Recommendation
Realisation

The evaluation of LabanAssist as a low-fidelity, mid-fidelity, and a high-fidelity interactive prototype enabled the ongoing refinement of interaction to develop in concert with expert recommendations, end-users of the system, and the design of interface artefacts that will assist with the documentation of movement as Labanotation scores. The expert heuristic evaluation and workshop emphasised the intimate relationship between the visual form and content of a product, and its ability to effectively communicate the subject matter for design. A foundation for the interface design of LabanAssist was therefore developed to compare and associate the practises of Labanotation with the visual form of a system that supports the interactivity required to facilitate the composition of movement as Labanotation scores.

The outcome of the preliminary product test contributed to the development of a new method of interaction. It did so by facilitating diverse approaches to interaction, while supporting the multiplicity of ways in which movement can be described for its documentation. This approach to documenting movement that LabanAssist facilitates does not suggest that it is possible to meet the expectations of all users of the system; nor is that possible. Instead, this research has resulted in the design of a system that members of the dance community can understand and are able to use. This is for the practical purposes of movement composition and the application of Labanotation, an arbitrary symbolic language used to describe movement, that few dancers make use of due to a limited understanding of its symbolic vocabulary.

The structure of interaction offered by various interface artefacts within LabanAssist combine to form a unified system. This system supports an operational method for the documentation of movement that is well aligned to the practises of Labanotation. Results from the final product evaluation suggest that the integration of an operational structure for the composition of movement in a digital environment enables members of the dance community to actively participate in the formation and description of movement for its documentation; one in which end-users of LabanAssist share in the mutual activities the system communicates and facilitates. This is achieved through the utility of LabanAssist, and enables others to realise their goals through participation and understanding. The formation of movement as Labanotation scores is subject to the
creativity of the individual, rather than positioning end-users of a system as passive receptors of information that is subject to the limitations and impositions of that system. This requires end-users of LabanAssist to generate their own ideas and experiences through interacting with the system to realise their goals. As Nelson (1957, p. 13) tells us:

Good design, like good painting, cooking architecture, or whatever you like, is a manifestation of the capacity of the human spirit to transcend its limitations. It enriches its maker through the experience of creating, and it can enrich the viewer or user who is equipped to respond to what it has to say. But it is a statement and not a gadget … It (design) reaches its full potential when it is experienced by a person fully equipped to understand and enjoy what it has to communicate.

In situations where design reaches its full potential, we can begin to understand the impact of form on the outcome of design products by successfully communicating an idea that enters into the experience of others. This is particularly relevant where the practical functions of a system, its usability, and visibility of form become useful, usable, and desirable to a community of users. This gives significance to: (1) the functionality or usefulness of a product to meet a distinct purpose; (2) the usability of a product that endows its users with the necessary variety to support diverse ways of thinking and interacting; and, (3) the visibility of a product to communicate an understanding of its service so that it may become valuable and desirable to a community that participates in its understanding.

Summary

In this chapter, the outcomes of an iterative design process created to assess the usability of the prototype application LabanAssist were examined. This was achieved through various types of prototype evaluations that lead to the design of a tool that has the capacity to accommodate diverse user interactions in the composition of well-formed Labanotation scores. I conclude the thesis in the following chapter by discussing the significance of treating form and matter as an integrated, organised whole. This is
with a specific focus on the design of products that serve to facilitate the production of technical content and enhance the human experience. I revisit the principle I proposed in Chapter Two, and offer recommendations for future directions of this research.
10 Summary and Discussion

Through art, meanings of objects that are otherwise dumb, inchoate, restricted, and resisted are clarified and concentrated, and not by thought working laboriously upon them, not by escape into a world of mere sense, but by creation of a new experience (Dewey, 1980, p.138).

Thesis Summary

This research looks at the unintended consequences of treating form and matter in isolation from one another. In particular, the significance this relationship has on the design and integrity of interactive products that function as support tools for reliable productive outcomes. Because of the consequences that can arise from a narrow conception of the materials of a design situation, and their synthesis in the creation of design products, I argue that the treatment of form and matter as an integrated and organised whole is essential to the formation of design products that effectively enhance the experience of others.

The obscurities in which things or matter, in and of themselves, are examined to better understand their nature are commonly confused by the worldview or perspective in which they are considered. Human-centred research investigations share similar concerns to this, and have a tendency to produce diverse and conflicting outcomes when seeking to understand what people say, think, and do (McKeon, 1987). This is the nature of pluralism in design. As a response to this pluralism, a poetic or productive science strategy is developed in this research as a means to contend with a variety of problems in the creation of LabanAssist. This is a strategic tool that focuses on the form, function, manner, and materials of the prototype application LabanAssist. This focus is better understood from a liberal arts perspective, where the difficulties that arise in the treatment of specific subject matters are addressed by different arts. In doing so, the shape of the design of a product that fulfils a distinct need and purpose is achieved. In the context of this research, the function of LabanAssist is to facilitate the accurate
composition of Labanotation scores for novice users of the language, and to do so within a framework that pays attention to the above issues.

Through the design of the prototype application LabanAssist, this research has demonstrated how the creation and actualisation of form, as Labanotation symbols on a score, extends beyond the functionality of a product to enter into the experience of others. The manner in which the immediate documentation, visualisation, revision, and amendment of movement is supported by the utility of LabanAssist; that enables the individuality and creativity of an artist or end-user to be expressed and preserved with greater syntactic and grammatical precision; is very important to the whole. An operational structure for this opens up the possibilities for innovation and imagination to guide the process of composing dance knowledge as Labanotation scores. As a result, this structure caters to diverse ways of thinking and acting in the process of documenting movement through the selection and manipulation of broad terms, based on the verbal vocabulary of Labanotation presented in the design of an interface. Therefore, LabanAssist offers members of the dance community an accessible method for documenting movement as Labanotation scores. This in turn augments the practises of movement analysis, dance scholarship, and literacy; and contributes to the rich cultural heritage of dance.

**Overall Need and Outcome**

The art of documenting movement practised by choreologists can be understood in parallel to that of musicology; where the study and analysis of movement and composition are essential to shaping an historical and cultural understanding of movement for present and future action. An objective record of dance knowledge cannot to be captured by current methods of technology. In the same way that preserving an orchestral work by means of a sound recording would introduce distortions to the preservation and interpretation of a musical work, a video recording of movement would not capture a representation of movement as intended by a choreographer.

The preservation of dance knowledge as movement notation scores provides members of the dance community with valuable cultural archives to recreate the past and also
cultivate contemporary art forms. For this reason, I investigated the function of movement notation systems in this research with a specific focus on the language of Labanotation. Embodied and actualised in a concrete representation of movement, the ephemeral art form of dance and movement begins to take shape in the careful arrangement and composition of movement on a score. The composition of Labanotation symbols on a score requires a warranted level of precision to maintain the integrity and quality of cultural historical records. This is necessary to provide a coherent and visual form and structure to the process of documenting Labanotation scores. To facilitate their accurate composition, I designed the prototype LabanAssist to offer an extension to the understanding and accessibility of Labanotation. This understanding can then develop beyond the practise of choreologists to other members of the dance community.

The design of interaction within LabanAssist works to encourage and guide practical action. It makes possible the realisation of movement by engaging symbols which become meaningful through the connections it establishes in the design of the interface. By actively participating in the documentation of movement, an understanding of dance knowledge is also communicated. This distinguishes the difference between an approach that marks the role of interaction design as being a fundamentally suggestive activity, or one in which a design product functions to project meaning through the design of an interface as a means to enhance the knowledge and use of arbitrary symbolic information. Rather, a practical understanding of Labanotation is gained through the experience of thinking, acting, and working with the objects that are its symbolic language; as opposed to merely augmenting a response to the stimulus produced in suggestive interactive environments. This is important because, in situations where symbolic information has no distinct meaning for novice users of a language, interaction that is self-actualising enables an intellectual value to be attached to symbolic objects through practical action and experience.

This research has shown that LabanAssist provides an aesthetic experience to the documentation of movement that is not only useful, but an enjoyable activity for the members of the community for which it was designed. This is also significant because the intent behind the creation of LabanAssist as a computational support tool did not take the technological development of its software as a priority. Taken from a human-
centred and participatory design approach, it works to bring differences together in
order to enhance the experience of others. It is envisaged that, when complete as a fully
functioning software application, LabanAssist will facilitate the exploration of
movement concepts, self-directed learning, and methods of self-assessment. Therefore,
to develop the prototype further and monitor its use over time would not only be an
advantageous undertaking with regard to extending its facility and evaluating its long-
term value and effect, but also as a means to enhance dance literacy to be able to
contribute to a wider cultural context of knowledge production that will extend across a
variety of movement disciplines.

**Thesis Contribution**

Design practise is a holistic view of design that simultaneously captures research and
practise. An example of this draws on the design strategy utilised when making the
prototype application LabanAssist. A poetic strategy leverages design through research,
and enables the discovery and creation of new knowledge; the capacity for which the
designer learns by inquiring into a design situation, and is guided by a unifying idea that
captures the potentiality of a practicable design outcome has a direct impact on the
development of useful, usable, and desirable products. To assist this development,
design is characterised as a conversation in order to enhance a designer’s ability to
conceptually develop novel design solutions in participative situations. A conceptual
framework for the management and generation of knowledge that involve dynamic
human interactions draws from second order cybernetics principles to further enhance
the development of human-centred design processes.

The collaborative development of LabanAssist has contributed to the design of a
framework for interactivity, which takes shape as new interactive interface artefacts.
This was found to be necessary for novice users of the system to be able to describe
movement. A principled approach to the integration of an operational structure for the
documentation of movement supported by the interaction design of these interface
artefacts offers two distinct advantages. First, supplying a structure for the technical
ordering and arrangement of Laban symbols on a score renders the function of
LabanAssist capable of documenting movement with greater syntactical and
grammatical precision. Second, while the design of this structure maintains the
technical accuracy of the composition of movement, it is not restrictive in its overall purpose. This leads to the principle suggested in Chapter Two that the structure of content provides form with a functional purpose and tropes; as poetic constructs work to orient conceptual thought and open up the potential for a variety of concrete possibilities. With specific application to this research, the use of tropes as poetic constructs enables end-users of LabanAssist to build relationships between the selections of broad descriptive terms in an interface, and then compose diverse descriptions of movement. In this way, thought and language become a motive for action that transforms the verbal vocabulary of Labanotation to a description of movement. This is represented by the abstract symbolic language of Labanotation as dance knowledge in the form of Labanotation scores.

The findings of this research gives emphasis to a designerly way of thinking and working in which an understanding for new knowledge can be developed; particularly in situations where a feeling of mutual involvement exists among communicating equals. By welcoming the perspectives of Labanotation by experts and students alike in the development of this research, it was possible for the designer to consider a wider range of suggestions for the development of the prototype. The benefit is the design of an operational method of invention for the documentation of movement that caters to a variety of users. The designer’s understanding of the situation, when joined to the ideas and suggestions from both new and experienced users of Labanotation, ensured that a wider range of needs and requirements in the design outcome of LabanAssist was possible.

**Future Developments**

The potential to develop this research beyond the functionality of a prototype application is not only very welcome, but also important because of the opportunity to pursue a much-needed avenue of exploration and implementation. This was achieved in affiliation with the Dance Notation Bureau Extension for Education & Research and the Advanced Computing Centre for the Arts and Design (ACCAD) at OSU. Therefore, LabanAssist will only be developed beyond that of a prototype application if this potential is further realised. It is envisaged that the ongoing development of the prototype will take shape as a cross-platform application, which will be made accessible
via the Internet. This will foster the continued involvement and participation of
Labanotation experts and students alike, which will ensure that the development of
future products will remain useful, usable, and desirable.
A counterpart to the final product evaluation test used in the evaluation of this research
would be to evaluate a student’s ability to compose a Labanotation score from a
sequence of choreographed movements. Therefore, a subsequent product usability test
would be conducted to further evaluate the usefulness of LabanAssist. This would
involve novice users of Labanotation actively engaged in an introductory Labanotation
course or curriculum, rather than involving students of an elementary-to-intermediate
level, to perform the final product evaluation.

The final usability testing procedure for the product evaluation was designed to evaluate
the functional and operational aspects of LabanAssist. This leveraged a student’s ability
to identify, interpret, and reproduce a completed Labanotation score. By conducting an
additional product usability test that evaluates a novice student’s capacity to create a
score from an experiential understanding of movement, further value would be given to
the function of LabanAssist as a computational support tool. The ability for students to
complete such a test would, therefore, not involve the reproduction of an existing
Labanotation score. Instead, it would rely on a student’s conceptual understanding of
movement and his or her ability to describe and document movement through the utility
of LabanAssist. As a result, performing this type of product usability test could either
identify problematic areas for future development or strengthen the findings of the
research.

**Recommendations for Future Research**

A greater understanding and concern for product integrity is essential when designing
products that seek to enhance the human experience. The implications for products of
design that fail to supply their end-users with a reliable end-purpose or function will
have a significant impact not only on the community of users it seeks to serve, but also
on the culture in which it becomes a valuable means of communication. In particular, a
failure to fully consider the implications of the products of design that give form to
specific types of information can be damaging to the productive outcomes they shape
and bring to realisation. In this sense, design is not considered as merely shaping the
visual style and appearance of novel or short-lived fashionable products. Instead, a future concern for design would need to be centred on the development of useful, usable, and sustainable products that become desirable to a community because of the value and service they offer to enrich their way of life.

Going forward, one future direction of this research would be to explore how the field of design can begin to develop an understanding and greater awareness of product integrity, and the implications this has for design as a discipline. The application of this topic is broad in relation to the form, function, and materials of design products that include the manner in which products are created. A focus on product integrity and the ethical dimensions associated with the synthesis of form in the creation of design products offers a valuable and rich field of inquiry in design practise (Buchanan, 2005). Furthermore, research where an examination of the structural integrity and functionality of dynamic systems and generative environments to support sustainable interaction would be advantageous.

Another avenue of research would be to explore the application of Labanotation to a variety of fields identified in Figure 4. Notation Systems in Fields of Application, and evaluate its usefulness towards enhancing user experiences with regard to time, space, and motion. The application of Labanotation could extend to the design of services in complex interactive environments, human computer interactions, or be beneficial to the development of tangible products and systems.

**Future Technical Developments**

The design of the technical content needs to be developed in concert with emerging technologies. I argue that the design of technological products should involve a variety of stakeholders in the creation of design products that give careful consideration to the needs and requirements of a potential community of users. This is particularly relevant when it concerns systems of interaction and interfaces designed to illustrate complex information that can be accessed visually. Designers equipped with the knowledge and ability to communicate across a variety of disciplines, and with a wide range of stakeholders in different use situations, are vital to the understanding of the impact of emerging trends in technology. Added to this will be the capacity for technologies to
communicate in ubiquitous computing environments. Therefore, developing strategic design approaches that enable designers to become active participants in the design situation, and to become better aware of the type of judgments made during the design process, will support this understanding. This will include strategies that can be leveraged to inform the use of design methods and techniques in practise, and examine their effect on resulting design outcomes. The successful ways of design thinking and working must be established with regard to the capacity of existing technologies to function appropriately. This view must capture the ability for technology to perform an intended function or purpose, and needs to look beyond simply a mechanistic approach to design. Moreover, this is imperative for sustaining a human-centred view in which design products are created to support the human experience. This focus contrasts significantly against a design science approach that takes the technological advancement of scientific knowledge as a priority for product development.

Design becomes a powerful approach to shaping cultural practises that move people to take action through the creation of services or products that fulfil a purpose, and offer value to a community of practise. The technological reasoning capable of rendering Labanotation symbols as intelligent symbols to ensure the integrity of their composition remains to be developed. Hatol (2006) and Calvert et al. (2005) suggest the creation of a dance ontology or machine-readable grammar that has the potential to develop in concert with new interactive environments will stem from the design of an extensible markup language (XML) to form the foundation for a Web ontology language (OWL). By taking a principled approach to the definition of such a grammar, it is envisaged that the syntactic and semantic elements of movement, consistent with Labanotation, will be effectively managed to represent and facilitate the translation of dance knowledge in a Web-based environment. This presents a possibility for the future technical development of LabanAssist, which could be leveraged for the design of a schema that correlates the interactivity of LabanAssist’s key interface artefacts to user actions.

The evolution of the existing 2D representation of movement within LabanAssist to a 3D representation of an animated human figure will better illustrate the information contained with Labanotation scores. It is envisaged that a human-centred design strategy will continue to lead the future development of LabanAssist. In this way, the actualisation of design products that give shape and are shaped by dynamic interactive
environments offer the potential for end-users of such systems greater flexibility in the way they think, act, and go about creating long-lasting cultural records. Rather than seeing technology as a limiting factor to the sustainability of a culture’s development, a design approach that seeks to overcome the obstacles identified in this research makes possible the design of a prototype application that allows individuals the freedom of variety and choice in the ongoing creation of valuable cultural knowledge.

**Ideal Design Outcome**

An ideal outcome for the design of LabanAssist would be the integration of the necessary technology to ensure the accuracy of Labanotation scores for novice to expert use. However, specific functional elements that provide end-users of the system with greater flexibility to create and save movement sequences and patterns would see the development of a proposed interface artefact called a Movement Library. The Movement Library would allow for the reuse and application of previously created movement structures to be added to a score. It would also enable movement patterns on an existing score to be saved to this Library. In this way, the functionality of the Movement Library would propose to increase the efficiency of writing repetitive movements, and facilitate the storing and accessibility of movements for future use.

To complement the continual development of Labanotation’s symbolic vocabulary, an interface artefact called a Symbol Glossary would enable the addition and modification of new and existing Labanotation symbols to be added to the facility of the system. Further refinement of the functionality designed to create and review floor plan structures would function to assist novice users of LabanAssist to attain a broad overview of movement before its detailed documentation. Within the Score Editor, the capacity for layered sections of Labanotation scores to be documented on different layers would work to ease the progressive development of complex writing skills. The eventual inclusion of Motif symbols, a precursor to the language of Labanotation, would also enable end-users of LabanAssist to gain a fundamental understanding of reading and writing a more basic set of movement concepts before tackling the structured form of Labanotation. The addition of LMA principles within LabanAssist could also be seen to add a valuable emotional component to the more qualitative and expressive description and documentation of movement. These suggestions represent an
ideal outcome for LabanAssist. However, the continued development of the prototype application LabanAssist, in its present form, would be with the intention of increasing the potential for dance literacy and, in doing so, broaden its field of application to a wider community of use.