Part IV: Research through Design


7 The Poetics of Initial Design Requirements

You cannot understand the problem without having a concept of the solution in mind; and that you can’t gather information meaningfully unless you have understood the problem but that you cannot understand the problem without information about it (Rittel, 1972b, p. 321).

Introduction

As with previous chapters, this research draws on both current literature and that of an earlier period because literature across this time frame best characterises the issues under discussion. It is important to understand that this chapter represents the formulation of ideas. In the design process, it is an idea that unifies a situation. A unifying idea gives shape to the overall process of bringing together the many different elements of a design situation in the creation of a solution. The importance of this characterisation lies in the identification of a starting point. This marks the possibility for a solution. The development of an understanding of the relationship between inquiry, observation, and ideation is significant to be able to understand form. In the early part of this chapter, I examined the types of interactive functions within existing dance notation applications that enhance the composition and interpretation of movement. I do this to identify what is effective or may be improved. In the following inquiry, I seek to ascertain if a number of interactive functions within existing or similar applications designed to capture movement can be utilised to enhance the composition and interpretation of movement, and support a variety of user interactions.

In order to gain a better understanding of the circumstances surrounding a design situation, I argue that it is important to have a mindset that is open to exploring and analysing the potential for an alternative solution. The greatest challenge in the early stages of the design process is assessing observations made about a situation that provides useful information to carry the development of an idea further. For the purposes of this research, the early definition of system requirements is central to the success of user interface design. It contributes to the overall effectiveness of a system
by providing a framework for the development of that system, which is then fundamental to the design of a product that is deemed to be useful, usable, and desirable; where the structure and content of a product’s form directly impacts its functionality and subsequent usefulness to meet a distinct purpose. This extends to the usability of a product designed with the necessary features and affordances that support a particular community of use and a variety of diverse user interactions. When the combination of these elements and a product’s ability to communicate visually is successful, it becomes desirable and enters into the experience of its users.

This research concerns the early conceptual development of the prototype application LabanAssist. It involves the creation of various design documents and system specifications that illustrate the overall concept, scope, and function of the prototype application. I examine the purpose existing notation applications serve, and the techniques they make use of to facilitate the composition and interpretation of movement. I develop specific criteria that provide a framework for the evaluation of existing notation applications. This is done to ascertain key elements of a systems functionality, usability, and visibility that can be leveraged to develop useful, usable, and desirable design solutions. On conclusion of the evaluation, I argue that an appropriate use of technology and functionality are necessary to augment the usability of a product and support the needs of its potential users.

The overall functionality of a system influences the design of interactive elements its interface supports (Armitage, 2003). Consequently, the interface design of these elements communicates the functionality of a system to its potential users. System functionality that draws on the outcome of this evaluation is used to define a provisional set of system features for consideration in the development of the prototype application LabanAssist.

Fundamental to the practise of design is gaining an understanding of user needs and requirements. This is achieved through communicating a plan for the formulation of a product’s structure with and for potential users of a system (J. M. Carroll, 2006). To achieve this, an approach that explores the knowledge of mutual design decisions and a means of making them explicit is pursued. This is a collaborative process in which agreement between potential users of the system and designer is discovered during task
analysis workshops. This is done in order to learn if designers can develop an understanding of the diversity of users’ needs and actions in interactive situations through collaboration, negotiation, and learning during participatory modelling activities.

I conclude the chapter by suggesting that a combination of visual tools may be utilised to facilitate the representation of this information, and communicate knowledge of the underlying design rationale and decision-making process. In this way, shared knowledge of design alternatives can be made explicit for their evaluation and eventual implementation into the prototype application LabanAssist.

Envision

The definition of a system’s requirements early on in the design process provides a foundation upon which a proposed system or prototype can be realised. It outlines a conceptual understanding of a system’s scope, its capacity for interaction, its limitations, and the potential for its further development. Definitions of these documents guide decisions made throughout the design process, and are used to evaluate its progress. This includes identifying usability goals, early functional requirements, constraints, and potential users of the system.

The function of envisioning system requirements is a preparatory one. Requirements are an estimation of system’s characteristics that are conceived, as opposed to those that are suitably devised for a specific use and context. The creation of a system concept sets the stage for a testing ground in which the appropriateness of systems features can be refined or eliminated for the purpose of its potential use. Preece et al. (2002) tell us that requirements are used to identify what an intended product should do, and how it should function to achieve this.

Typically, innovative design is the result of observation, experience, emulation, and the analysis of existing or similar developments in a specific field (Preece et al., 2002). To further the development of dance notation applications and provide user-friendly tools that facilitate complex processes more easily, it is necessary to examine interactive features within existing dance notation applications. This will provide an insight into
suitable and unsuitable uses of functionality that, upon evaluation, may be leveraged for
the conceptual development of an alternative prototype application that assists the
composition of movement.

**Notation Applications**

The benefits of preserving movement are wide-ranging. These benefits are the result of
creating, writing, recording, viewing, and storing movement; as examined in Chapter
Four. A key objective in the development of notation applications is to provide the user
with an unambiguous method of recording and representing movement (Calvert et al.,
2002). Developers of notation applications (Calvert et al., 2002; Calvert, Fox, Ryman
and Wilke, 2005; János Fügedi, 1991; Herbison-Evans, Hunt, and Politis, 2003; Lake,
1990; R. J. Neagle, 2003; R. J. Neagle et al., 2004) provide us with a comprehensive
description and an historical account of the research and development of the
applications that record, edit, interpret, visualise, and produce movement.

Computer applications for the representation of movement are categorised as Notation
Applications, Multimedia Applications, Notation-based Applications, and Dance
Technology; and offer varying functionality in their use of technology (see Figure 7.
Notation Applications). Notation Applications record or interpret movement and use the
symbolic vocabulary of movement notation systems. Multimedia Applications
incorporate various educational applications produced either on CD ROMs or as
informative tutorial-based Web sites. Notation-based Applications use dance notation as
a basis for their development. The last, Dance Technology, consists of applications that
utilise emerging technologies to record and visualise movement. A product of these
applications can be the display of creative multimedia elements to complement dance
performances, or the representations of movement assisted by technological means.

As outlined in Chapter Three, the creation, rehearsal, and reconstruction of dance works
by choreologists, dancers, and choreographers is made possible by the use of existing
dance notation applications. Each system is designed with a specific use of functionality
and technology to meet the objectives of various-use situations among members of the
dance community. It is widely acknowledged that notation systems are difficult to
master. The function and approach to the design of notation applications has a direct
impact on the facility, utility, appearance, and usability of these systems. Since the
1980s, computers have been supporting the composition, editing, and interpretation of
dance notation systems (T. Calvert et al., 2005; Herbison-Evans, 2003; Lansdown,
the development of notation applications has been to satisfy the need to assist in the
creation and planning of dance choreography (Calvert et al., 1993; T. Calvert et al.,
2005; Hutchinson Guest, 1984; R. Ryman, 2001), and to enhance the use and education
of notation systems (Calvert and Chapman, 1978; T. Calvert et al., 2005; K. Hachimura
et al., 2002; K. Hachimura and M. Nakamura, 2001; Harrington, Delaney, and Fox,
2001; Hutchinson Guest, 1984; S. Marion and Boggia, 2001; Marriett and Topaz,
1986). More recently, this has included the production and interpretation of
Labanotation scores to and from digital animation (I. Fox et al., 2004; K Hachimura et
al., 2005). However, the analysis of early notation systems identified a need to improve
the system models that facilitate the machine-readable representation of Labanotation
data (Brown and Smoliar, 1976), and to format the correct positioning of notation
symbols on a score (Smoliar, 1978). To date, these complex issues remain significant
obstacles to their successful future development (T. Calvert et al., 2005; Ebenreuter,
2005).

An Appropriate Use of Materials

Despite these obstacles, greater human computer interaction is now possible because of
the integration of emerging technologies and sophisticated interactivity within computer
applications work to support the operation of enhanced functionality to alleviate
complex computer processes (Ebenreuter, 2005). Nieminen et al. (2004) argue that
innovative products and clever uses of functionality often are the result of novel
applications of advancing technologies. Such technologies are the fundamental
materials of the design situation. Further to their argument Nieminen et al. (2004)
maintain that emerging technologies—the materials of the design situation—can be
appropriately leveraged if their use is suitably designed to support the needs of potential
users and augment the usability of a product. While the evaluation of technology in
Chapter Four determines a suitable use of technology for the preservation and
interpretation of movement, it remains essential that its appropriateness for members of
the dance community with limited knowledge of Labanotation be considered.
Specific uses of technology and their functionality enable computers to facilitate the learning of notation systems and to assist in the composition, editing, and interpretation of notation scores (Calvert et al., 1980). Advances in technology prompted the design of an “interlingua” (I. Fox et al., 2004). It assists a method by which Labanotation is translated via existing and future uses of technology into an animated digital representation and vice versa (I. Fox et al., 2004). This technology enables the translation of motion capture data or animation to notation, video data to notation, and has the potential to synchronise animation, motion capture data, and video with notation (I. Fox et al., 2004). Score creation by novice users of Labanotation and greater access to the information they communicate are potential gains from the development of “interlingua” (Calvert et al., 2002; R. Ryman, 2001). As a result, dancers, choreographers, artistic directors, and ballet masters could make use of existing Labanotation scores by the translation of notation to and from an animated form. Ryman (2001) suggests that the dual method of translation could be useful to professional notators for the production and verification of notation scores. This is achieved through a comparative analysis of the documented movement and the resulting animation.

This process of verification would enable professional notators to refine their scores by allowing them to recognise discrepancies between their writing and its translation to animated movement. While this approach offers distinct advantages for the experienced notator, the benefits of score verification would present considerable difficulties for individuals without an advanced knowledge of Labanotation. This is because of the complexity required to interpret the visual abstraction of Laban symbols and the knowledge necessary to appropriately identify and correct inaccuracies in a score. Furthermore, the dual method of translation is exacerbated by emerging technologies that record and translate movement data, and require additional refinement by a skilled notator (Calvert et al., 2002; R. Ryman, 2001; Wang, 2004). While the reverse translation of Labanotation scores has the potential to provide greater accessibility to the information they contain, the automatic translation of these scores impedes the development of dance literacy by limiting the necessity of reading and writing Labanotation to skilled professionals. This suggests that facilitating the comprehension and interpretation of notation systems by novice users has the potential to enhance dance literacy for those without a professional understanding of its practise.
According to Hutchinson Guest (1984) and Damle (2002), an effective approach for developing an understanding of the movement dance notation systems communicate is the education and training in such systems. Consistent with the findings in the evaluation of technology that interprets and visualises movement, Ryman (2001) recognises the benefits of 3D animation as an appropriate use of technology to illustrate the information contained within notation scores, and to facilitate the education of notation. Hachimura and Nakamura (2001) argue that an understanding of human movement for its reproduction can be communicated to students in a manner more appropriate for dance education through a combination of Labanotation and computer graphics (CG) animation than digital video. Furthermore, Wang (2004) maintains that the generation of animated movement from notation scores allows for an intuitive approach to the education of Labanotation.

**The Impact of Functionality on Form**

An interface is the only channel of communication between the form of a product and user to transfer knowledge about the functionality it offers (Singh et al., 1983). Singh et al. (1983) maintain that the success of a user interface is crucial to the overall effectiveness of a system. They argue that the greatest difficulty in designing interactive systems is devising an appropriate method of interaction capable of supporting specific user tasks (Singh et al., 1983). This is because key elements of a system’s interface are generally the result of the functionality they provide (Armitage, 2003). Calvert et al. (1993) discuss the influence during the design process of a close association between the design of an interface and the functionality it supports. Beyer and Holtzblatt (1998) maintain that designing the structural elements of a systems configuration and function precedes the design of a user interface. Therefore, it is necessary to determine an appropriate use of functionality prior to the design of an interface. To assist the design of interactivity required to develop specific user tasks, interaction design methods can be utilised to develop logical and effective uses of functionality (Armitage, 2003). As a component of user-interface design, interaction design techniques can be leveraged to impact on the appearance of an interface capable of offering its users novel uses of functionality to achieve their objectives (Armitage, 2003).
Innovative design can be achieved through the adaptation, evolution, or direct replication of elements found in existing or similar products (Preece et al., 2002; Shneiderman and Plaisant, 2005a). Calvert et al. (2005) confirm this by acknowledging that the features designed for the application DanceForms share strong similarities with the technology used to create human figure animation. Comparable features identified in leading animation systems were adapted to suit the functionality required by members of the dance community to choreograph movement (T. Calvert et al., 2005). In addition to this Ryman (2001) informs us of the Dance Notation Bureau’s Interface Project designed to explore the complementary uses of DanceForms and LabanWriter to facilitate the translation of Labanotation scores to computer animation. This suggests that the adaptation of successful uses of functionality is beneficial to extending the efficiency of their utility to a wider user audience.

Leaders in dance research, notation, and technology (T. Calvert et al., 2005a; Curran, 2001; I. Fox et al., 2004; János Fügedi, 1991; K. Hachimura et al., 2005; Sheila Marion, 2001b; Rey and Bastien, 2001; Venable, 2001a) continue to explore the function of Labanotation in dance notation applications. Members of The International Council of Kinetography Laban/Labanotation and conference participants convene biannually to collaborate in the development of new solutions that offer advanced uses of technology to promote the use of Labanotation within the dance community. At the International Conference Exploring Research and Programming Potential for Labanotation in 2004, it was proposed that a master program be developed that combined the best features of LabanWriter, Calaban (The University of Birmingham, 2001), and Labanatory with additional features identified by the committee (I. Fox et al., 2004). While this proposal was declined, it highlights the potential to provide users with a range of enhanced functionality within a single notation application. Furthermore, the amalgamation of existing uses of functionality, already familiar to current users of notation systems, has the potential to augment the design of a highly interactive and useable system that caters to a wider user audience.

Evaluative Method of Functional Requirements for LabanAssist

To support the design of an application to assist novice users in the composition and interpretation of Labanotation, it is valuable to the development of alternative design
solutions to analyse current dance notation applications (Beyer and Holtzblatt, 1998; Preece et al., 2002). Don and Petrick (2003) argue that the definition of a structured evaluative framework, based upon a set of heuristic methods, is necessary to establish in order to conduct product evaluations. In doing so, this enables specific strengths and weakness of existing notation applications to be identified, and provides a foundation for design innovation. Therefore, central to the method of heuristic evaluation is the design of an explicit set of criteria. It is essential to this evaluation that these criteria illustrate the capabilities in which a system operates to support complex user tasks and functions.

I do not intend to conduct a thorough assessment of existing dance notation applications in the evaluation of functional requirements for dance notation applications. Preece et al. (2002) and Benyon et al. (2005) use the term “functional requirements” to specify the extent and manner in which an intended product should perform. Hence, in the following product evaluation, I distinguish the advantages and limitations of functionality within current dance notation applications to define the high-level functionality for LabanAssist, and to determine an appropriate set of features for further development.

I identify from available literature critical aspects concerning the functionality, usability, visibility, and the representation of dance notation applications to enable the creation of form (Benyon et al., 2005; Beyer and Holtzblatt, 1998; I. Fox et al., 2004; Jakob Nielsen, 1992; Norman, 2002; Preece et al., 2002; Shneiderman and Plaisant, 2005a). I take this literature into consideration to enable each criterion that I design to signify to a distinct requirement. The criteria listed below provide a framework to document the strengths and weaknesses of existing uses of functionality that I identify within dance notation applications. Fundamental to forming the structure and interface design of a system is its usability and visual representation (Beyer and Holtzblatt, 1998). This means that it was necessary to consider these additional elements in the evaluation of functional requirements for dance notation applications and the implications for the resulting form.
These specific elements include:

- **Functionality**

  1. Enable the accurate documentation of notation with an emphasis on a score’s structure and syntax.
  2. Facilitate the production, interpretation, revision, and amendment of notation scores in an immediate digital environment.

- **Usability**

  1. Allow for an ease of use suitable for novice-to-expert users of dance notation systems and first-time to frequent users of notation applications. Give priority to novice, first-time, and occasional users.
  2. Provide adequate system guides to alleviate user error.

- **Visibility**

  1. Communicate the functionality of a system by visually representing its facility and user options.

Movement is communicated to specific target audiences through the function of various dance notation applications. This intentionally defined approach makes it necessary to examine specific uses of functionality, usability, and visual representation; and then to evaluate the impact on the design of an alternative solution for the composition of Labanotation. Literature that focuses on the design and development of various dance notation systems (Calvert et al., 2002; T. Calvert et al., 2005; Calvert et al., 2001; I. Fox et al., 2004; K. Hachimura et al., 2002; K. Hachimura and M. Nakamura, 2001; Sheila Marion, 2001a; S. Marion and Smith, 1999; Rey and Bastien, 2001; R. Ryman, 2001; Singh et al., 1983) are used to assess specific aspects of the following applications against the above criteria:

- **LabanDancer**
By documenting the functionality, usability, and visual representation of existing dance notation applications against the above criteria, I establish a method of investigation that emphasises the distinct aspects of each system (see Table 4. Product Evaluation).

**The Useful Functions of a System**

Shneiderman and Plaisant (2005a) maintain that efficient methods of system interaction are made possible through the meaningful organisation of menu items. For the purpose of this examination, the guiding principle of functionality requires the interaction design of a system to indicate a systematic approach to the composition of notation scores. This is done in order to facilitate the introduction of an operational method for the documentation of movement into the prototype application LabanAssist, which I discuss further in Chapter Nine.

A distinct challenge to the documentation and amendment of movement is the accurate positioning of notation symbols on a score at a precise moment in time (Singh et al., 1983). This is because of the manner in which any combination of symbols on a score not only indicates variations of their physical position in space, but also the time and duration for which they are performed (T. Calvert et al., 2005; Singh et al., 1983). The correct sequential formation of notation symbols upon a score is comparable to the strict arrangement of letters used to construct and spell words in a sentence. Movement can be documented in a single frame of movement or across a set of frames within an entire score (Singh et al., 1983). This division in time is similar to the structure of letters that when combined make up a single word; a word in a sentence; or a number of sentences
### Table 4. Product Evaluation

<table>
<thead>
<tr>
<th>Notation Applications</th>
<th>Functionality</th>
<th>Usability</th>
<th>Visibility</th>
</tr>
</thead>
<tbody>
<tr>
<td>Benesh Editor</td>
<td>✗✓</td>
<td>✓</td>
<td>✗</td>
</tr>
<tr>
<td>LED &amp; Linter</td>
<td>✗✓</td>
<td>✓</td>
<td>✗</td>
</tr>
<tr>
<td>LabanEditor</td>
<td>✗✓</td>
<td>✓</td>
<td>✗</td>
</tr>
<tr>
<td>LabanWriter</td>
<td>✗✓</td>
<td>✓</td>
<td>✗</td>
</tr>
<tr>
<td>LabanReader</td>
<td>✗✓</td>
<td>✓</td>
<td>✗</td>
</tr>
<tr>
<td>LabanDancer</td>
<td>✗✓</td>
<td>✓</td>
<td>✗</td>
</tr>
<tr>
<td>DanceForms</td>
<td>✗✓</td>
<td>✓</td>
<td>✗</td>
</tr>
<tr>
<td>Limelight</td>
<td>✗✓</td>
<td>✓</td>
<td>✗</td>
</tr>
<tr>
<td>Calaban</td>
<td>✗✓</td>
<td>✓</td>
<td>✗</td>
</tr>
<tr>
<td>Labanory</td>
<td>✗✓</td>
<td>✓</td>
<td>✗</td>
</tr>
<tr>
<td>Not Applicable</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Key**

- ✔️ Strengths
- ✗ Weakness
- ✗ Not Applicable
in a paragraph. As such, it is important to consider the relation of these elements between part-to-part, part-to-whole, and whole-to-part. This is because understanding the dynamic relationships between these elements is significant in the creation of form as an organised integrated whole. This is where the treatment of matter and form, with reference to Laban symbols (matter), and their correct grammatical and syntactic composition as Labanotation scores (form), is crucial to facilitating the preservation of dance knowledge.

To assist the composition of movement, research by Calvert et al. (1993) put emphasis on the necessity for a hierarchical method in which to describe movement. This suggests that an appropriate tool set containing a suitable range of notation symbols should be included in a system to support varying levels of movement descriptions. In contrast to this, Lansdown (1995) maintains that the usefulness of a notation application is dependent on a complete range of notation symbols. In comparison to the English language alphabet, which consists of twenty-six letters, complex dance notation systems that accommodate a comprehensive range of movement can make use of a symbolic language that consists of up to seven hundred symbols, or more. The technical complexity involved in including a complete set of movement descriptors as a necessary feature of a system is outside the scope of this research. Nor is it necessary, if as suggested by Calvert et al. (1993), an appropriate tool set that supports the needs and requirements of a specific community of users can be determined.

Existing notation applications contain, at minimum, a basic tool set of movement descriptors and modifier symbols. The functionality required to supply users with a range of symbols that make up even the most basic symbol set for their selection and use is challenging. Both LabanWriter and Labanatory provide users with a comprehensive set of Labanotation symbols. Labanatory achieves this through the functionality provided in the system’s main menu bar. It relies on user selection to initiate the display of categorically arranged symbol palettes that correspond to the text descriptions listed within submenus of the main menu. LabanWriter offers a similar function through the selection of visual icons which, for the most part, are Laban symbols without textual description. These icons are contained within a tool bar that is made visible as a default function of the system. To the inexperienced user, the abstract representation of these icons inhibits their selection because the utility they represent is
indiscernible. Furthermore, the display of successfully selected symbol palettes in both systems described are arranged by category, leaving the clarification of individual Laban symbols identifiable only to those with a knowledge of Labanotation.

Apart from the accessibility of these symbols, a practical approach to ensuring their correct selection and formation upon a score is not incorporated into the functionality of these systems. Calvert et al. (2005) tell us that the most widely used notation editor in the field, LabanWriter, has little capacity to detect or prevent semantic inaccuracies made during the composition of Labanotation scores. This limits the notation editor’s ability to identify errors of syntax in Labanotation scores, or to support their legitimate composition. To resolve this issue, the creators of the software Labanatory have proposed the development of a system function to validate the correct spelling of Labanotation scores (Gábor, Misi and Fugedi, 2002). Nevertheless, current notation editors in their existing state remain ill-equipped to facilitate these needs (T. Calvert et al., 2005).

In comparison to the above-mentioned notation applications, LabanEditor utilises Labanotation to provide users with the ability to input, edit, print, and display movement in an animated form. A user interface is designed to enable a method of composing Labanotation that employs the use of various “symbol selection buttons” (K. Hachimura et al., 2002, p. 61). These buttons facilitate the functionality required by users to specify the basic attributes of notation symbols, yet requires knowledge of their composition to create a score. A preview window is used to display this information in stick-figure animation, and a motion viewer translates this to a 3D human figure animation. Developments surrounding this application offer the potential to automatically translate motion capture data to Labanotation data and produce Labanotation scores in LabanEditor (K. Hachimura and M. Nakamura, 2001). While this application supplies users with complex interactivity, it has yet to be exclusively contained within the LabanEditor (K. Hachimura et al., 2002).

A separate editor and interpreter is invariably required to facilitate the translation of notation scores to and from an animated form (Calvert et al., 2002; K. Hachimura et al., 2002; Herbison-Evans, 2005; R. Ryman, 2001). This is exemplified by the interfunctionality existing between LED and Linter, LabanWriter and LabanDancer;
and the various components that contribute to the functionality of LabanEditor. The application Limelight (Griesbeck, 1996) proposes to combine the functionality of an editor and interpreter within a single application; however, its status of development remains incomplete.

The Usability of a System

User performance can be assessed by usability criteria that highlight the efficiency, learnability, and memorability of a system (Preece et al., 2002). The guiding principle of usability in this examination specifies the method of interaction a system offers for it to be easy and enjoyable to use. Singh et al. (1983) tell us that well-designed systems of dialogue between a system and user can enhance user thinking. Systems that assist the operation of interaction should also include task specific help functions that are simple to identify and straightforward to use (Shneiderman and Plaisant, 2005a).

The success in which an interactive product appropriately accommodates user needs and tasks is essential to the usability of a system (Preece et al., 2002). The lack of error detection and score verification within existing notation applications, and the absence of a means to counteract them, are problems for the documentation of movement. These problems suggest that current applications are directed to the use of professionals with an expert knowledge of Labanotation. As discussed in “Research Findings” of the “Evaluation of Technology That Interprets and Visualises Movement” in Chapter Four, the need to develop a system model capable of ensuring the correct formatting of Labanotation scores has been identified. A system that facilitates the correct composition and comprehension of Labanotation, through enhanced methods of functionality, offers the potential for an alternative solution (Ebenreuter, 2005). For the purposes of this research, the usability required to support the correct documentation of Labanotation by novice users of the language is taken as a priority. The extent to which the level of usability is considered extends from a focus on novice use with the potential capacity for expert use, and first-time to frequent users of notation applications.

Permissible system actions can be maintained by utilising distinct interaction styles to direct and assist user performance. Systems that constrain the options available to users during controlled sequences of interactivity can prevent user error (Norman, 2002;
Preece et al., 2002). The application LabanWriter exemplifies a use of constraints that conceals and reveals menus and functions relevant to specific user modes. When these user modes are rendered operational, they present the user with exclusive uses of functionality to meet an immediate objective. While these functions are specific to a particular task, users are generally unaware of the system’s overall functionality, which can limit the successful operation of specific tasks (Ralley, 2005).

Two contrasting techniques of interaction have been identified by the developers of the Benesh Movement Notation Editor for communication between a system and user (Singh et al., 1983). These developers (Singh et al., 1983) tell us that system-initiated dialogue instructs a user in the method of interaction a system offers; while user-initiated dialogue allows a user to control and instigate the actions a system performs. Therefore, suitable levels of support are required to develop a system that assists the documentation of Labanotation scores for novice use. This requires a system that initiates specific tasks and functions; alleviates the necessity of memorising complex processes of interactivity; and provides users with immediate system feedback (Shneiderman and Plaisant, 2005a; Singh et al., 1983). While system-initiated design is less efficient or as flexible as user-initiated dialogue, it is more appropriate for novice use (Norman, 2002; Singh et al., 1983). Shneiderman and Plaisant (2005a) argue that universal usability can be achieved through the appropriate integration of interactive objects and actions to mutually support the tasks of novice and more experienced users of a system. This is achieved through a multilayered approach to learning, where task-based functions are designed to support the advancement of a user in the design of the software and help facilities (Shneiderman, 2003; Shneiderman and Plaisant, 2005a). It is important to understand that universal usability is not the goal of this research. However, systems designed with the purpose of accommodating users of varying skill sets provide a basis that can be leveraged in the functional design of LabanAssist. This is for the purpose of creating a design product that seeks to embody the necessary functionality to support task-based operations and to enhance user performance.

The Visibility of a System’s Form

Interface design principles, guidelines, and rules can be used to support the effective development of a user interface (Benyon et al., 2005; Shneiderman and Plaisant,
2005b). For the purpose of this examination, the interface design of a system is required to support the visibility of its functions, operating state, and its resulting form. Norman (2002) identifies visibility and feedback as central to the usability and understanding of a system. This suggests that interactive processes required to facilitate the composition and amendment of movement notation scores should appropriately represent the status of these tasks.

Alternate views of system features can work to simplify complex tasks (Calvert et al., 1993). This refers to the use of specific windows or sections of an interface for displaying different aspects of a particular function. The Benesh Movement Notation Editor utilises a display window to illustrate a portion of a Labanotation score, while a working frame is used to display an enlarged view of the score (Singh et al., 1983). This facilitates the positioning and manipulation of notation symbols. To supply users with the current status of a score, a body menu represents parts of the human body that require specification. This is before a sequence of movement is considered complete (Singh et al., 1983). As a result, the visual representation offered by the combination of these windows assists users in locating, positioning, and identifying the necessary course of action required to notate a frame of movement.

The demonstration of complex movements permitted by various angles and perspectives that 3D technology enables can be useful to assist the visualisation of movement (R. Ryman, 2001). The prototype application LabanDancer accentuates the information contained within Labanotation scores by translating its symbolic language to a 3D representation of movement. The interface enables users to scroll through select frames of a score, and immediately compare the representation of these symbols in a 3D animated form. Moreover, the facility provided by the technology of 3D animation enables users to observe this movement from any visual perspective, thus supporting the clarification of movement concepts.

Effective interface features that appropriately address the various skill levels of its users can increase the usability of a system (Shneiderman and Plaisant, 2005a). Existing notation applications that find use within the field of dance education supply users with enhanced interactive features that support the visual clarification and interpretation of dance notation systems and scores. They assist beginners in identifying, reading, and
interpreting these notation systems and scores. The application LabanReader is used to emphasise specific characteristics of time, space, and patterns found in Labanotation scores (Sheila Marion, 2001a). It displays Labanotation symbols in different colours and groups in order to focus attention on specific elements of movement sequences for analysis (S. Marion and Smith, 1999). The application Calaban (The University of Birmingham, 2001) also exhibits select elements of a score to assist with a progressive understanding of Labanotation symbols. To support the comprehension of complex rhythms, LabanWriter offers users the ability to incorporate numbers alongside Labanotation scores. This provides users with a visual indication of a score’s tempo with reference to its accompanying movement. LabanWriter (Ohio State Department of Dance, 2008) also equips users with the option to superimpose visual grids on top of floor plans during their creation, which serves to clarify its spatial point of reference.

**Initial Design Requirements**

The Evaluative Method of the Functional Requirements for LabanAssist above has identified specific advantages and limitations of a given number of dance notation applications (see Table 4. Product Evaluation). A focus on the functionality, usability, and visibility of these systems (that parallel the usefulness, usability, and desirability of a product) suggests the degree to which LabanAssist could operate more effectively. The evaluative method for the functional requirements of LabanAssist provides a basis upon which the creation of high-level functions and features for the prototype application (LabanAssist) can be further developed, which will offer reliable alternative solutions to current dance notation applications.

Existing applications that seek to enhance the accessibility of Labanotation scores for the dance community are offered through the development of LabanDancer and LabanEditor. However, underlying concerns surrounding the practical and technical use of Labanotation highlight the potential to develop applications that will facilitate the learning and composition of its symbolic language. Research by Yasuda (2001) focuses on the difficulties students have in comprehending the fundamentals of several dance notation systems. It suggests that the simplicity offered by DanceForms is preferable to students as a tool for developing movement analysis (Yasuda, 2001). Calvert et al. (2002) tell us that experience using the applications LabanWriter and DanceForms
prompted members of the dance community to propose that a connection should be made between these two systems. While the development of LabanDancer closely resembles a response to this suggestion, a comprehensive use of functionality that includes the facility to write, edit, and visualise movement; within a single application; would foster the education of Labanotation beyond the translation of its symbolic language. This is very important because it will not only overcome existing problems, but will also impact positively on the symbolic use of notation, which will allow for the greater recording of movement and result in a richer cultural heritage.

New interactive environments can be developed to allow for greater human-computer interaction through the development of sophisticated interface design and the implementation of emerging technologies to visualise computer graphics (Ebenreuter, 2005). The integration of an operational structure for the composition of Labanotation that provides user feedback and preventative measures, within notation applications, should support the correct syntax of score creation (Ebenreuter, 2005). This should simplify the process of composition to assist those with little knowledge of the intricacies of Labanotation and enhance dance literacy (Ebenreuter, 2005). Devising a way to ensure the correct structural composition of Labanotation scores could contribute towards the efficiency of translating notation-based data to animation.

System requirements provide, by definition, a starting point from which the proposed functionality of the prototype LabanAssist should perform. These specifications include the definition of high-level features, functionality, and usability goals.

The high-level features for the prototype application should encompass:

1. A 3D animated representation of the movement information contained within Labanotation scores.
2. Contextual help to display rule based writing information.
3. Visual devices to assist the correct documentation of Laban symbols in regards to their positioning within the correct columns of a score and their length according to the time structure and duration of movement.
4. Useful feedback to support the composition of movement that is anatomically impossible or breaks the system’s rules of use.
5. Pre-existing templates for the set-up or adjustment of generic staffs and musical tempos.
6. Enhanced interface and interactive features that enable users with little knowledge of Labanotation to construct Labanotation scores effectively.

The high-level system functionality for the prototype application should:
1. Facilitate the composition, interpretation and amendment of notation scores in an immediate digital environment.
2. Facilitate the accurate syntactic and grammatical documentation of Labanotation symbols.
3. Function as a diagnostic tool in which novice users of Labanotation have the ability to evaluate their notation and more easily interpret errors in their notation.
4. Provide a structured process to the documentation of Labanotation scores.
5. Communicate information visually to enhance system interaction.
6. Combine the technology of Labanotation and 3d animation, within a single notation application to assist the visualization, evaluation and amendment of Labanotation during the composition process.
7. Advance the skill level of a novice user of Labanotation.
8. Engage users of the system in the composition of movement.
9. Detect and prevent errors made during the composition of Laban scores.

The high-level user functions for the prototype application should provide users with the ability to:
1. Notate, interpret, revise and amend notation scores in an immediate digital environment.
2. Compose Labanotation scores with greater syntactic and grammatical accuracy.
3. Evaluate their notation and more easily interpret errors in their notation.
4. Be guided by a structured process in the composition of Labanotation scores.
5. To identify the relationship between animated movement and symbolic representation.
6. Visualise, interpret and evaluate the information within Labanotation scores through a 3D animated figure, within a single application.
7. Increase their skill in using Labanotation.
9. Identify with the functionality of a system through its mode of visual representation.

High-level usability goals for the prototype application are as follows:

1. Affordances
   The design of an interface should supply a user with an indication of the functionality a system provides. A clever use of text and graphics should communicate what will be done before they are activated.

2. Match between system and the real world
   The system design should make use of terms and concepts that are familiar to the user that ideally correspond to real world conventions.

3. User control and freedom
   In the event of user error, system functions should be clearly marked to enable the termination of a function without having to complete an extended system of dialogue.

4. Consistency and standards
   Ideally the design of a system should make a consistent use of words and interactive functions that follow a uniform set of conventions.

5. Error prevention
   The careful design of a system would ideally prevent user error and eliminate the necessity of implementing extensive error messages.

6. Recognition rather than recall
   The method of functionality a system offers should be easy to use. Users should not be required to remember the dialogue of interaction between system and user. Interface objects, actions and options should be made clearly visible and retrievable when warranted.
7. Flexibility and efficiency
A system can be designed to cater to the needs of novice and more experienced users. Interactivity that accelerates system processes, such as short cuts, facilitate the expert use of a system.

8. Aesthetic and minimalist design
The interface design of a system should remain relevant and efficient in its ability to communicate visually. To ensure the clarity of an interface, extraneous uses of interactivity and visual graphics should be removed.

9. Help users recognize, diagnose, and recover from errors
Ideally error messages should clearly identify a problem that is easily understood and suggest an appropriate solution.

10. Help and documentation
While it is preferable to design a system for use without instructional documentation it is usually necessary to supply users with this information. Help menus should be simple to search and present solutions to users tasks in a clear and concise manner.

11. Effectiveness
The system design should function appropriately to assist users in achieving their objectives.

12. Ease of use
The system should allow for an ease of use, suitable for novice to expert users of dance notation systems and first time to frequent users of notation applications.

For the practical purposes of this research, novice use of the prototype application is given a priority in its development. With this in mind, I propose the design of a system framework that extends the potential capacity of the application to expert use. It is envisaged that the combined technology of Labanotation and 3D animation, within a single notation application, will operate as a diagnostic tool. This functionality should support the creation, visualisation, evaluation, and amendment of Labanotation during the composition process resulting in form.
Optional features that provide further assistance in the use of system tasks and operations will accommodate a wide range of user situations for those with varying Labanotation skills. Features identified in the evaluative method of functional requirements for LabanAssist can be leveraged for the development of a comprehensive notation system. Preliminary interface designs illustrate the early conceptual development of these features (see Figures 13–16: LabanAssist Preliminary Interface Designs). Research that provides an overview of educational institutes offering dance notation studies (see Figure 2. Dance Notation Educators and Institutions) suggests LabanAssist should be beneficial to students learning Labanotation at universities located predominantly in the U.S., the UK, and elsewhere. The prototype application will be a cross-platform, Web-based application. This will serve both Macintosh and Windows operating systems for use on standard desktop or laptops computers that make use of customary input devices such as a keyboard and mouse.

To begin this development, it is necessary to first understand the way in which designers can develop an understanding of the diversity of users’ needs and actions in interactive situations. An understanding of the potential for diversity gives shape to the functionality of design products, which are not only carried forward by a single idea in the mind of a designer, but should also capture the needs and requirements of its potential users. It is important for the practice of design that the shaping or framing of a design situation is not an individualistic activity, but one that seeks to capture useful knowledge about its potential community of use through collaboration, negotiation, and learning during participatory modelling activities. In this way, the framing of design situation becomes an art of bringing differences together to serve a variety of human activities to reach a common goal.

Frame

There are a variety of techniques in which participatory design methods are practised in the design process. The ability to meet the collective needs of a community has a direct relationship with the usefulness of product. The successful combination of what is considered useful and useable in a product becomes desirable to a community when the value it offers in purpose and function enables its end-users to reach a common goal.
Figure 13. LabanAssist Preliminary Interface and Menu Design
Figure 14. LabanAssist Preliminary Interface and Panel Design
Figure 15. LabanAssist Preliminary Interface, Document and Library Design
Figure 16. LabanAssist Preliminary Movement Editor Design
For the purposes of this research, the value of a product is seen in terms of its capacity to facilitate the cultural expression of dance knowledge. This knowledge can be shared between a community that participates in its creation, performance, scholarship, dissemination, and preservation. In order to achieve this, the development of a dialogue is required between the user and the system. This should follow a logical and disciplined course of action, and will facilitate the selection and definition of a comprehensive range of movement. The organisation of this information should assist users though a series of interactions to describe movement that results in the correct composition of Labanotation scores. A basic description of movement should define distinct elements of the body, its spatial orientation, duration, style of performance, and related options.

The focus of this research is to determine how designers can develop an understanding of the diversity of user needs and actions in interactive situations. In particular, I examine a way to develop, document, and represent knowledge created during task analysis workshops. I do this in a visual schematic to better understand the users’ perceptions of their needs and requirements. It also briefly examines what types of information can be visualised, and the types of problems they represent and enable us to solve. Moreover, I seek to understand how schemata can be used effectively in collaborative working situations to model an appropriate course of action for the creative practise of notating movement as Labanotation scores.

The purpose of modelling or framing a structure for the documentation of movement is to establish participants’ views and consolidate the manner in which movement can be thought about, described, and documented in its practical application. Grasping an understanding of the circumstances and the potential issues or conflicts in the design situation is instrumental in the creation of usable products that accommodate a variety of needs. Developing a preliminary framework for understanding the potentialities of a design situation provides a powerful tool for enhancing user observations and gathering meaningful information from focus group activities (Novak and Gowin, 1984). This knowledge not only informs and guides the actions of the designer, but also the processes that drive product development.
A Framework for Interactivity

Just as the range and scope of human movement is vast, so is the diversity of its description and the possible combinations of elements used to describe it. Therefore, a systematic approach to the description of movement is inherently difficult to structure, predict, and manage. Labanotation is a rigorous system comprising of more than seven hundred symbols. Grammar in this context means the devices to check spelling during score composition. Without appropriate suggestions on the use of grammar within the current notation applications, or a thorough knowledge of Labanotation’s conventions, the creation of dance notation scores is subject to human error and a nonsensical expression of its cultural heritage. This is because the composition of Labanotation scores are subject to the individual selection and manual placement of Laban symbols on a score that, when combined, represent a description of movement.

Software applications for dance notation applications do not possess the semantic knowledge to correct dance notation scores. These software applications are different from text-editing applications such as Microsoft Word that contain spell-checking devices to ensure the correct grammatical composition of words and, to a certain extent, sentences. Assumptions made by computer software systems, or the lack thereof, are made known to us on occasions where correctly spelled words that have no direct intelligible meaning within a sentence remain undetected. For example, “A letter was sent [not ‘from’] the post office.” Errors of this nature highlight the limitations of computational tasks, which increase in complexity with languages such as Labanotation that make use of copious numbers of symbols. At present, these issues impinge on the expert use of notation applications in as much as the systems designed for this purpose limit the broader accessibility of dance notation, regardless of user capabilities. I argue that computer applications or products that are ill-equipped to support the sound composition of movement notation scores impact on the safeguarding and cultivation of a culture’s heritage and identity.

As McGarry (1993) argues, it is the interaction between the letters of a word and the words of a sentence that provide variation in meaning; rather than its linear sequence. The manner in which symbolic information can be represented to convey the knowledge of dance movement is as interchangeable as its context of use. This representation can
be through a variety of symbols in isolation from one another, or as a unity of
expression consisting of a mixed range of symbolic information. Movement can also be
expressed in an instant, a beat, a measure, or as many instances of beats in many
measures that constitute a complete score. This is, however, dependent on the
movement it represents because two movement sequences can be written with
comparable consistency and accuracy, while utilising very different symbols and
methods of approach.

The process of composing movement is further complicated by unwritten and
circumstantial writing conventions that govern the practise of Labanotation (Hutchinson
Guest, 2005a). This is where the addition of subsequent symbols to a score can
contextually alter the meaning and interpretation of existing symbols. Then again, the
absence of a symbol on a score in one beat of movement can indicate the carry-over of a
movement position from a previous frame. This complexity means that there is a need
to maintain a reasonable level of syntactic and grammatical precision in the structural
composition of Labanotation scores. That is, its technical composition, consistent with
syntax and grammar, governs the rules that form the basis of the deep, underlying
structure of language (Chomsky, 1977). Not only is this necessary to reduce the
likelihood of error, but it also is needed to facilitate the preservation of Labanotation
scores for future analysis, interpretation, and reconstruction. A framework of
interactivity is, therefore, required to assist the composition and interpretation of
Labanotation scores that reflect the practise, conventions, and structure of its use in
order to avoid these issues.

**Mapping Interface Objects and Actions**

Labanotation is a language that members of the dance community rely upon to describe
movement. This language follows a grammatical structure that is used to posit actual
movement with appropriate words. As with most written and verbal grammars,
Labanotation can be broken down and classified as nouns, verbs, and adverbs. A noun
can refer to individual body parts that move; a verb to the action or positioning of a
body part; and an adverb to indicate the duration and style of its performance
(Hutchinson Guest, 2005a). These elements are then used to create descriptions of
movement just as sentences are formed in natural languages such as the English
language. While this approach illustrates a linguistic analysis of Labanotation, elements of the language can be distinguished with regard to the motivational and analytical concepts that underpin its use. Hutchinson Guest (2005a, pp. 12–13) identifies these in relation to their directional destination, motion, anatomical change, visual design, relationship, weight, balance, dynamics, and rhythmic pattern; which have a direct impact on the form of movement descriptions and method of analysis. The significance of these movement characteristics lies in the potential to develop a foundation for the description of movement that utilises the conceptual, verbal, structural, and motivational or actionable elements of Labanotation to communicate a dialogue between system and user through the design of an interface.

As a foundation for information architecture, an object-oriented, noun-verb interaction model provides designers with a framework that can be used to develop new methods of interaction, in application, to target specific user tasks and goals (Raskin, 2000; Shneiderman and Plaisant, 2005b; Tidwell, 2006). When the grammar and syntax of movement specification offered by Labanotation is adapted for use with a noun-verb interaction model, it provides an effective framework for the design of interactive task structures that assist the selection and description of movement. Figure 17. Mapping Movement and Interactivity for the Interface illustrates this association. A method of modelling system operations and actions in this way corresponds to the logic of describing and documenting movement with a system of interaction. Therefore, a structure of interaction that is relatively straightforward for the user to remember is made possible when corresponding movement constructs; or broad terms that assist an integrated description of movement elements; are assigned to recognisable task objects and actions.

I do not consider the assignment of movement constructs to task objects and actions as fixed categories. This is despite an implied association because of their assignment to a particular arrangement or ordering. Dewey (1910) tells us that orderly interaction may follow if an object or item is recognised and considered in relation to a key subject or theme. This is made possible when the identification and association between the broad terms that facilitate interaction is consistent with the theme it suggests. For that reason, the organisation of thought can be as a result of organised action or a number of interrelated interactions surrounding a particular subject or idea (Dewey, 1910).
The Language of Dance: Elements of Movement

**NOUNS**
- Other Person, Partner
- Performer’s Body
- Parts of Room
- Props Objects
  - Specific Body Part(s)
  - Involvement of Body Part(s)

**VERBS**
- Absence of Action, Stillness
- An Action
  - Contraction
  - Rotation
  - Extension

**Spatial Actions**
- Path
- Direction
- Toward (approach)
- Away (withdraw)

**Progression, Support, Balance**
- Supporting
- Springing
- In Balance
- Falling

The Object Action Interface Model: Elements of Interactivity

**OBJECTS**
- Parts of the Body
  - Limbs
  - Joints
  - Body Areas
  - Areas & Surfaces
  - A Limb
  - Both Arms
  - Left Arm
  - Right Arm
  - Both Legs
  - Left Leg
  - Right Leg
  - Neck

**ACTIONS**
- Motion
  - Contraction
  - Rotation
  - Extension
  - Inward
  - Outward
  - Untwisted/Parallel
  - Motion
  - Contraction
  - Rotation
  - Extension
  - Bend
  - Stretch


**Figure 17. Mapping Movement and Interactivity for the Interface**
This is where the significance of the conceptual, verbal, structural, and actionable elements of Labanotation comes into play; when an idea and its active formulation, regardless of its foundation, becomes the organising principle behind the realisation of what is expressed (Burke, 1969b).

Rather than the categorical representation of particular objects or things, the significance of tropes as poetic constructs (discussed in Chapter Two, “Symbolic Communication”) enables different perspectives and understandings to be developed from the recognition of similarities and differences surrounding a key term. This is where the term “body part” can broadly refer to the notion of footstep, or any other body part for that matter, which can be further defined and made specific by the inclusion of the terms “forward,” “place,” and “middle.” These rather ordinary terms share similarities across all movement descriptions, and offer a place to refine broad concepts of movement. The theme in this example is relevant to the descriptive elements required by the language of Labanotation to create a single movement. It identifies the differences between the parts of the body, and also makes use of similarities relevant, but not necessary, to its description or physical positioning. Poetic constructs, as opposed to categories, offer a starting point or place in which meanings can be negotiated. Rather than rely on the selection of a limited range of possibilities, which categories suggest, tropes open up alternate possibilities to develop interaction that integrates thought and action in an orderly manner.

**The Boundaries of Grammar**

When devising an appropriate course of interaction to assist a diverse description of movement and the potential combinations of its elements, it is necessary to involve potential users of the system to envision a flexible structure to guide its composition. This is because how one conceives, performs, speaks, and documents movement differs significantly in their various forms of expression. Because of the nature of this diversity, the correct syntactic and grammatical formations of symbolic writing systems in language pose distinct challenges to the composition and communication of dance knowledge. With regard to the technical communication of dance knowledge by members of the dance community who rely on such notation systems, the formation of these symbols has little relevance as a guiding principle for their correct structural
composition. The grammar rules that underpin the structure of Labanotation reveal very little about the practise of their art in application to the composition of dance notation scores. By developing a prototype application that removes the need to have specific knowledge of these rules, I argue that a structure that corresponds to the theory and practise of Labanotation needs to be developed so that the underlying principles of the language may be learned through actively engaging with the functionality the prototype application provides.

For Gropius (1955), the ability to move freely within the bounds of a grammar that he envisioned for design was essential to the creative expression of ideas and form. In particular, he stressed the importance of an objective scientific knowledge of the theoretical underpinnings of the art which he refers to as a “language of vision” (Gropius, 1955). Gropius (1955) rejected the notion that imitating old ways of thinking and working were of consequence to the development and careful cultivation of a visual language for design. While not the same, this closely resembles the set of circumstances surrounding the imitative modes of dance preservation that undermine the development of the art because of the imprecision in which information is lost from the knowledge of one performer to another. With this in mind, the challenge for this prototype application LabanAssist is not to explicitly enhance the syntactical knowledge of Labanotation, but to facilitate the orderly documentation and preservation of movement concepts in a way that correlates to its grammatical formation.

High levels of flexibility that enable users to progress, regress, and revert specific actions within a restricted sequence of interaction, bounded by the rules of the grammar of Labanotation, are vital to the success and usefulness of the system’s long-term use. In addition to this, the kinesthetic knowledge and range of motion that is physically possible to perform will strengthen the boundaries in which movement is expressed. For Chomsky (in Radford, 1981), grammar equated to a model of linguistic intuitions. This is because native speakers of a language have the capacity to make intuitive judgments about the acceptability of the form and structure of sentences. Based on the concept of a universal grammar, such intuitive judgments are the result of individual beliefs, verbal language skills, and knowledge concerning what is and is not plausible (Smith, 1999). This is where a repertoire of movement knowledge and the verbal vocabulary of Labanotation supply a foundation for similar judgments to be made by novice users of
Labanotation. The conventions of Chomsky’s (in Smith, 1999) transformational or generative grammar suggest that there exists an intimate relationship between the deep structure of language, its syntax, and the surface structure of a language; its semantic interpretation. Meaning is acquired as a result of the interplay between the two in which the underlying structure of language gives emphasis to its understanding. However, this did not lead to the notion that syntax is a reflection of surface structures (Chomsky, 1977). Instead, Chomsky (1977) tells us that there is connection between the ideas we create and the forms of syntax, but that this does not stem from the rules of semantics or syntax to their compositional form. He (Chomsky, 1977, p. 59) argues that:

We might, then, loosely think of a transformational grammar from a semantic point of view as a mapping of a structure of thematic relations onto a kind of logical form.

The significance of this concept is that it explains how seemingly arbitrary symbolic representations become meaningful and useful to the generation of language structures or sentences based on what we ourselves produce. If we accept the notions put forward by Chomsky (1977), then we begin to understand how the boundaries of formal grammar can work to increase the potentialities of language through the concept of transformational grammar.

**Visual Schemata**

A language of vision best describes the illustrative power of diagramming and visual schematics. The notion of a visual language is in reference to the nature of abstraction and objectivity in which schemata enable designers to literally examine a diverse array of ideas. Visual representations of information or data far removed from their contextual surroundings enable designers to gain insight into the intricate relationship between the parts of a design situation and its whole. However, this is not necessarily an isolated view. Schematics facilitate the collaborative understanding and development of ideas, and assist us to look objectively at the actions and decisions we make (Novak and Gowin, 1984). One context for their use is for developing and analysing specific sets of tasks and actions that allow diverse groups of individuals to reach a common goal.
Arnowitz et al. (2000) tell us that the purpose and representation of task analysis data is as diverse in design as the methods and theories that support their development. While their research (Arnowitz et al., 2000) concentrates on a drawing technique for the representation of task analysis data, it is necessary to understand what type of resource task analysis data provides, and how this information may be designed to be more useful to the participants involved in their creation and development. Therefore, identifying what type of information can be documented and how it can be visualised is central to facilitating the development, documentation, and representation of various accounts of human activity through collaborative discussion and agreement.

Three types of visual tools exist that effectively represent and structure information. Hyerle (1996) defines these as: (1) “brainstorming webs” for idea generation; (2) “task-specific organisers” for the order of operations and hierarchical structures; and, (3) “thinking process maps” for the comparison and connection of ideas. The significance of these tools lies in their ability to characterise knowledge in a form that facilitates the active generation, ordering, comparison, and analysis of information in a collaborative environment. Specifically, they enable the construction of individual human thought to be made explicit in dynamic forms for analysis (Hyerle, 1996).

While each tool presents a distinct purpose for its use, a combination of these tools can be used to visualise information in an integrated form, and to facilitate participatory task analysis workshops (Natalie Ebenreuter, 2007). If used effectively, a visual schematic that utilises components of task-specific organisers and thinking process maps can provide a line of reasoning that makes design decisions explicit. Through collaborative discussion and mutual understanding, an argument for specific modes of interaction and design artefacts can be made. This requires a designer to act as informant and collaborator in the early modelling of unstructured tasks; and as analyst in the development and rationale of design outcomes.

During a participatory task analysis workshop, participants work together to collaboratively construct a task analysis schematic. The basis of this schematic is illustrated in Figure 18. Task Analysis Schematic. To begin, I defined a functional requirement (labelled “R”) and then associated with a specific user goal (labelled “G”). Various user tasks (labelled “T”) that accomplish this goal were then created by
Figure 18. Task Analysis Schematic
participants in order to define their utility and relevance to the goal. Documenting this information on a whiteboard or materials such as note cards or “Post-it” notes enables participants to openly contribute to and develop tasks as a group. Once documented, this enables collaborative discussion and comparative analysis between the various task descriptions to develop. This follows a second-order cybernetic understanding, where new knowledge is developed collaboratively as a result of participation, conversation, learning, and mutual understanding (discussed in Chapter Six, “A Conceptual Framework”).

The outcomes of these discussions are supported by the documentation of arguments for or against their use. This is achieved by visually connecting a description of the various claims made to the appropriate task under examination. The number of participants that contribute to the task analysis, in conjunction with their arguments for and against the ordering of tasks, establishes the number of positive and negative rankings for the proposed task structure. The strength of the positive claims represented in the task analysis schematic creates an argument for a particular course of action to be taken. To determine the underlying rational for the creation of design artefacts (labelled “D”), it is necessary to synthesise these findings. This is where I propose a description of a design artefact that seeks to address the issues raised in support of completing a specific goal. As a final step in this process, I add an explanation (labelled “E”) relevant to the claims for the design artefact as a means to justify the suitability of the design outcome.

Summary
The design of a product evaluation used to critically examine and analyse the functionality, usability, and visual representation of existing dance notation applications has, by necessity, provided a foundation in which the formation and subsequent design of interactive elements for LabanAssist have been established. The evaluative method of functional requirements for LabanAssist provided an insight into the strengths and weaknesses of various uses of functionality within dance notation applications, which led to the initial characterisation of system features for a specific community of use. The intent in doing so was to better accommodate the various levels of expertise surrounding the use of Labanotation.
Outcomes of the evaluation suggest that the notation applications LabanReader, LabanWriter, LabanDancer, and Calaban; utilised in the field of dance education; supply their users with enhanced interactive features. These features can assist novice users of Labanotation to identify, read, and interpret Labanotation symbols and scores with greater ease. This suggests that a number of interactive functions within existing or similar applications designed to capture movement can be used to enhance the composition and interpretation of movement and support a variety of user interactions. As a result, the design of LabanAssist will espouse and implement a combination of the features found in these applications. This is essential to better suit end-user needs and requirements. It is envisaged that the inclusion and adaptation of an existing and familiar set of system features, known to members of a specific field or community of practise, can enhance the usability of design products.

A preliminary model for user tasks and system interactions is provided because a grammar for Labanotation took shape through a noun-verb interaction paradigm that used objects and actions to specify the structure of system operations. This model draws on the theory of transformational grammar (Chomsky, 1977) and extends the possibilities of the use and expression of Labanotation. However, it requires application to the dynamic environment for which it is designed; that is, for productive purposes suited to members of the dance community. To assist this, an alternative approach to the design and representation of task analysis data for the development of interactive systems, with and for end-users, also is also offered.

The development of visual schematics in the suggested form facilitates the collaborative communication of potential design outcomes that give shape to the functionality of interactive artefacts. Furthermore, utilising a combination of visual tools that subscribe to the techniques of task-specific organisers and thinking process maps (Hyerle, 1996) not only facilitates the collaborative development and subsequent judgment of design issues, but also provides a flexible technique to gather useful information in a range of design situations that are beneficial to participatory design practises. This underpins the notion that designers can develop an understanding of the diversity of user needs and actions in interactive situations through collaboration, negotiation, and learning during participatory modelling activities.
A graphic interface with explicit interactions and components is required to facilitate a
systematic approach to the exchange of information between system and user. To
achieve this, the approach offered enables the knowledge of mutual design decisions
during task analysis workshops to be made explicit. In the following chapter, I develop
an understanding as to how interaction and interface artefacts can be appropriately
designed to structure complex information, and also accommodate diverse use
situations within a particular community of use. This is based on the collaboration and
agreement between potential users of the system and its designer, in conjunction with
other data collection techniques, to better understand user needs and requirements, and
further the development of LabanAssist.
8 Design Rationale

The experience of having participated in a problem makes a difference to those who are affected by the solution (Rittel, 1972, p. 320).

Introduction

In this chapter, I examine the difficulties associated with designing an appropriate system of interaction between an artist and system that will work to facilitate the composition of Labanotation scores. I do this to better understand the complexities of describing movement and the creation of Labanotation scores with computational support tools for novice users of the language. The range of human movement is vast. For that reason, a systematic approach to the description of movement is inherently difficult to structure and predict. Accordingly, Labanotation is a complex system that consists of more than seven hundred symbols. The composition of Labanotation scores are contingent upon the selection of individual symbols that, when combined, represent a description of movement. When devising an appropriate course of interaction to assist the generation of diverse descriptions of movement, it is necessary to involve potential users of the system to envision a means of designing a flexible and operational structure to guide its composition.

In the following inquiry, I seek to better understand the unifying idea or concept behind the activity that actually shapes the composition of movement. To achieve this, an understanding of how potential end-users of a product create form is required. An examination of the manner in which Labanotation scores may well be composed with the symbolic language of Labanotation is needed to meet this requirement. Furthermore, these symbols are understood to be the materials or matter used to create form. Labanotation symbols are the signs and symbols that constitute the basic elements of Labanotation. Understanding the manner in which these symbols are then used to shape and structure the form of Labanotation scores, to represent movement, is at the core of this inquiry. This is based on the understanding that the composition of movement is an operational activity. It is important to understand that key terms that offer broad
descriptions of movement concepts are considered as constructs that facilitate the creation and documentation of movement. This is as a result of the interactions and meanings we associate with Labanotation symbols, regardless of the grammar rules established by the theory of Labanotation. With this in mind, I seek to ascertain if interaction and interface artefacts can be designed to structure complex information, and allow for diverse use situations through a play of tropes, represented as broad associations of terms in the design of an interface.

The active involvement of learning with and from dance students new to the language of Labanotation, in conjunction with expert recommendations from Labanotation educators during the preliminary stages of the design process, made it possible to gain a comprehensive overview of the scope and potential for the application of Labanotation as a sophisticated system to describe movement. Insight gained through a collaborative understanding of the circumstances surrounding the design situation worked to assist the development of interaction and interface artefacts. This knowledge shaped the constraints of the prototype application, and provided a means by which to organise and arrange complex information. This in turn transformed from a conceptual understanding of user needs and requirements to the interaction and visual interface design of the prototype application LabanAssist.

In the development of interactive environments and computational support tools, a variety of issues can arise, particularly when a designer’s understanding of the key objective of a system and its associated tasks is vastly different from an end-user’s or artist’s understanding. This is complicated further by the need to support a novice level of understanding of Labanotation, and to facilitate the correct approach to composing Labanotation scores underpinned by Labanotation theory and its education.

Understand

A designer’s involvement and understanding of the potential issues and consequences that can arise in the early stages of designing a new product is central to the creation of useful, usable, and desirable products. This is particularly the case when designing for members of a specific community of practise that have distinct ways of thinking, working, and creating not generally known to individuals outside their field or
discipline. To facilitate this investigation, participatory design techniques that involve users in the design process assist in capturing individual and collective accounts of user needs and requirements.

This approach is built upon the understanding that user-centred design and participatory design processes serve as effective approaches to adapting technology for greater ease-of-use (Sanders, 2006). Carroll (2006) tells us that a greater understanding of the function end-users provide in characterising the variety of human activity in design planning and development has seen their active involvement in the design process at a much earlier stage. The users’ role as informants during interviews, task analysis workshops, card-sorting techniques, and the development of use case scenarios provide designers with valuable experiential information regarding the process of conceptualising and describing movement. When combined with the testing of products that involve the observation of users who think aloud while composing Labanotation scores, participatory design processes offer designers a broad range of techniques to develop interactive systems for the documentation of Labanotation scores.

The above-mentioned list of participatory design techniques can be used in any number of interactive situations, regardless of the field or discipline to which they are applied (Sanders, 2006; Luck, 2007). Carroll and Rosson (2007) describe the participatory design process as one of collaborative social negotiation that deals with both moral and pragmatic concerns in the act of designing. For the purposes of this research participatory design techniques are used to support the understanding required by a designer to appropriately consider the conceptual form, function, manner, and materials of the design outcome. However, this is not from the single perspective of a designer, instead insight is gained collaboratively with and for end-users of a potential product. For the creative productive purposes of this research, participatory design techniques are used to form the practical basis of the productive science or poetic strategy I discuss in Chapter Six, “A Poetic Strategy for Making” and “A Place for Creativity.” Again, this strategy is one that is guided by the working development of a design solution as opposed to imposing a distinct set of rules on a particular way of working, thinking, or making. This research is therefore developed as a result of a shared understanding acquired through the active inquiry into a problematic situation and interacting with the elements of the design situation in collaboration with potential end-users of the system.
Fundamental to the adaptation of a suitable framework for describing movement by novice users of Labanotation is the involvement of students not yet completely familiar with the grammatical structure and general use of the language of Labanotation. A variety of assumptions or misconceptions regarding the purpose and difficulties associated with completing specific task objectives can impinge on the interaction design of user tasks if a designer’s understanding of the task is vastly different to that of the users. As a result, the design and development of the prototype LabanAssist involved Labanotation students of an introductory to intermediate standard, and Labanotation experts and educators from OSU’s Dance Department. Their active participation in the conceptual design, development, and evaluation of the system played a significant role in determining the interaction and interface design of the prototype application.

The involvement of Labanotation experts in this research also provided valuable insight into the development of interaction considered necessary for the description and documentation of movement. Outcomes of the knowledge garnered from expert interviews worked to corroborate the information understood from the student-focused inquiries. Thus, the combination of student and expert participation in this research allowed for the co-creative development of an interactive system for the description and documentation of movement to be created. The following techniques that underpin a poetic design strategy were used to elicit information considered to be essential to the interaction and the interface design of the prototype application. The following sections provide a summary of the specific techniques used in the design of this research, which include the aim of the research approach, its procedure, and ensuing results.

**Expert Interviews**

For the purpose of this research, expert interviews were conducted with educators of Labanotation. These educators used notation applications as support tools to enable learners of the language to document and interpret movement with greater ease of use. Structured interviews with experts in a specific field of knowledge provide a useful technique with which to identify the needs and goals of a distinct community of practise or knowledge production. Therefore, these interviews were designed to plan and conceive a way to classify the process of describing movement. In addition, they served
to develop an understanding of an educator’s perception of the difficulties that students face in learning to read and write Labanotation. This involved five experts with backgrounds as educators, directors, and notators of Labanotation. They were each interviewed individually, and were asked a series of ten identical questions:

1. How do you describe the process of notating movement to students?
2. How would you categorise this process into a logical sequential format?
3. What additional elements of motion are associated with the key descriptors of movement?
4. When are modifiers of Laban symbols used in the composition of movement?
5. Should the modification of movement be made directly to the object in question at the time of its description?
6. When are orientation guides such as floor plans and the use of pins incorporated into the composition of movement?
7. Should directional guides be defined as a movement is composed or as a final element in the composition of movement which follows a sequential description of that movement?
8. From your experience in teaching Labanotation what do students frequently have difficulty with?
9. Do you have any suggestions that may be beneficial to assisting learners of Labanotation to compose Labanotation scores using notation applications?
10. What is essential to the practice of teaching Labanotation with notation applications?

Outcomes of these interviews suggest that the process of documenting movement is intimately connected to the type of movement being described and a notator’s preferred method of writing it. A description of movement can begin with the creation of a floor plan, which provides a broad outline, framework, or plan for subsequent movement to be described. A description of the parts of the body that supply the impetus for a complete description of movement will have as its focus the finer nuances of movement. This, in part, contributes to a unified description of movement, where a relationship exists in a technical sense from part-to-part, part-to-whole, and whole-to-part. As a result, this has a significant impact on the way in which movement is subsequently conceived and described. Therefore, it is not surprising to learn that
novice users of Labanotation experience difficulties in the documentation of movement as Labanotation scores which stem from the manner of differences in the way movement is envisaged.

In the education of Labanotation, experts make use of two prominent terms referred to as “supports” and “gestures” that characterise particular qualities of movement. These terms are used to classify two considerably different types of movement, and support the process of formulating a conceptual understanding of movement for its description and documentation. “Supports” are used to describe weight-bearing movements such as the placement of one’s feet to support the weight of the body when landing from a jump. “Gestures” refer to non-weight-bearing movements such as that of a seamless, delicate arm movement. The distinction between these two classes provides a foundation for the conception and description of a variety of movements, just as the documentation of these descriptions, as symbols on a score, provides a basis for the timing and rhythm of movement. From a technical standpoint, difficulties associated with the documentation of movement most commonly concern the correct placement and necessary length of Labanotation symbols on a score. In particular, this concerns the size and positioning of symbols on a score that appropriately indicate the duration of movement for a particular part of the body in time.

As a result of the expert interviews, it was suggested by Labanotation experts and educators that the form of similarly shaped Labanotation symbols are increasingly difficult for novice users of the system to identify and interpret. This can lead to the production of vastly different outcomes in their interpretation and performance. Once documented, the identification of Labanotation symbols, as patterns of movement, can be read vertically along a score as a means to interpret consecutive movements in time. In addition to this, whole movement positions can be read horizontally along a score as individual poses or positions of movement. This is significant since these types of visual structures cater to a variety of user capabilities in the reading, writing, and understanding of Labanotation scores. Furthermore, the need to understand these types of visual structures and patterns underpins the necessity for a flexible framework that supports these processes.
Among the recommendations made to augment the documentation of movement are the following. These recommendations were influenced by the expert interviews during the development of the prototype LabanAssist and highlight the need to:

1. Maintain an uncomplicated level of movement description to reduce the possibility for error;
2. Establish a better understanding of the rules attached to Labanotation’s grammar and structure;
3. Provide system feedback that anticipates potential errors in score and movement composition;
4. Develop a source of reference material for Labanotation writing rules that can be made readily accessible to students during the composition of scores;
5. Create of a way of capturing an overall path of a performer’s spatial orientation to enhance the process of creating floor plans; and,
6. Design educational tools and materials that enhance student learning by presenting ideas in their most simple form.

In this way, students may focus on distinct goals and build upon a fundamental understanding of concepts learned.

**User Modelling**

User-centred design and participatory design practises place the potential users of a system or product at the heart of the design process (Ehn, 2003; Norman, 2002). In essence, these processes seek to capture user diversity in a way that is useful to the designer of a product that emphasises user capabilities, their needs, and the functions required to achieve a variety of goals for a distinct purpose. User modelling is one method by which designers can, for practical purposes, bring differences together to create a broad notion of the potential end-users of a product. In doing so, this modelling serves as a vehicle that gives focus to the endeavour of enhancing the user experience for a number of individuals. This is important because a mismatch between the perspectives of the designer and a particular community of use, coupled with varying perceptions of an envisaged product, can lead to the development of a design outcome that serves substantially different purposes. Therefore, gaining an understanding of how
potential users of a product contend with the use of technology, their knowledge of Labanotation, and their key purpose for achieving their goals are factors that contribute to the definition of the needs and functions that will serve them (Saffer, 2007). Developing a fictional character or persona based on this knowledge represents a way in which designers can envision the potential for variety in the tasks and functions that certain individuals may perform, which may be different to the ability of others (Don & Petrick, 2003). They also give significance to the rationale behind the design artefacts that are made in concert with the manner in which people think, work, and act to achieve particular goals.

Results from expert interviews, a persona questionnaire (see Figure 19. Persona Questionnaire), and observations made during interaction with students and staff associated with learning and teaching Labanotation at the OSU contributed to the design of three conventional personas. The first, a dance notation educator, illustrates a mature person with a strong background in dance notation systems and a deep understanding of student limitations surrounding the use of Labanotation, and who takes a need-to-know approach to the use of computer software. This persona is clarified through a positioning statement. This is articulated as a primary focus, and seeks to assist students to gain a comprehensive understanding of the faculty of Labanotation (see Figure 20. Expert Persona). The remaining two personas are characteristic of a female (see Figure 21. Student Persona 01) and a male student (see Figure 22. Student Persona 02) perspective. These in turn exemplify highly motivated and creative individuals that identify with computer technologies relatively easily, and emphasise the frustrations they face in learning Labanotation. Each student persona identifies the potential capacity for the use of Labanotation in his or her future career path. Two further individual positioning statements underpin these personas.

The identification of the prerequisites for the prototype tool was assisted through a greater understanding of the community for which LabanAssist is created. Designed for novice users of Labanotation, the term “novice user” in this regard refers to a student undertaking tuition in a dance-related discipline and an introductory course of Labanotation. An understanding of music and rhythm is advantageous to the student, but not essential. While these personas are conventional representations of a much larger user audience, they provide a basis to leverage when making judgments.
Circle one of the following

Knowledge of Notation Systems: Labanotation / Benesh Notation / Other: ____________

I have a PDA (Personal Digital Assistant): Yes / No

I have an MP3 Player: iPod / Other: ____________

Primary Device: Laptop / Desktop

Computer proficiency: Competent / Skilled / Highly Skilled

Add Details

Future Occupation (e.g., dancer, choreographer, notator, educator):
__________________________________________________________________________

Dance Major: __________________________________________________________________

Laban Frustrations: __________________________________________________________________
__________________________________________________________________________
__________________________________________________________________________
__________________________________________________________________________

General Technical frustrations with computers: __________________________________________________________________
__________________________________________________________________________
__________________________________________________________________________

Circle Yes or No

Are Laban symbols hard to position in the correct column?: Yes / No

Are pins hard to write in the correct position?: Yes / No

Is it hard to recognise errors in your Laban score?: Yes / No

Do you find rhythm difficult to understand in a Laban score?: Yes / No

Is it hard to interpret the meaning of Laban symbols?: Yes / No

Is it hard to notate jumps considering the upbeat?: Yes / No

Is it hard to notate turns and twists considering the use of pins?: Yes / No

Is it important to understand the movement in Laban scores by performing it?: Yes / No

Is it hard to recognise the difference between space measurements and the bending and stretching of limbs?: Yes / No

Figure 19. Persona Questionnaire
Dance Notation Educator

**Personal Details**
- **Name**: Jane
- **Age**: 48
- **Education**: PhD in Dance Notation Systems
- **Occupation**: Dance Educator
- **Attitudes**: Dedicated to learning & teaching
- **Marital status**: Married
- **Children**: None

**Dance Knowledge**
- **Notation Systems**: Labanotation & Benesh
- **Styles**: Modern, Classical, Jazz, Tap, Musicals
- **Dance Documentation**: Professional Dancer & Notator

"I want students to gain a comprehensive understanding of Labanotation. Not only to read and write Laban scores but also to analyse and embody the movement information they contain."

**Technology Usage**
- **Computer**: Mac
- **Cell Phone**: None
- **PDA**: None
- **Other**: ipod
- **Primary Device**: Desktop
- **Web Use**: Daily
- **Computer proficiency**: Need to know basis
- **Applications**: Word, LabanWriter, PowerPoint, Excel, Email
- **Technical limitations for student learning**

The capacity of technology to display nuances of movement and communicate the function of a Laban score is limited. This is demonstrated in situations where students are required to determine the correct positioning and length of Laban symbols on a score that match a specific time signature. These limitations are also apparent in the misinterpretation of similarly shaped Labanotation symbols. Furthermore, the use of modes in LabanWriter has created confusion in regards to a student’s understanding of the overall functionality of the system.


**Figure 20. Expert Persona**
Dancer

“\[inline]I want to write dance enchainments in Labanotation and read choreographic scores and dance syllabuses in a variety of dance genres.\[inline]”

Personal Details

Name  Emily
Age  25
Education  Graduate Student
Future Occupation  Dancer, Dance Educator
Attitudes  Highly motivated
Marital status  Single
Children  None

Dance Knowledge

Notation Systems  Labanotation
Styles  Modern, Classical, Jazz
Dance Documentation  Weekly
Major  Contemporary
Laban Frustrations
A lack of knowledge regarding the identification and correct use of Laban symbols. The accessibility of information within notation editing applications could be more efficient. Positioning symbols on a score at the correct height according to the time signature also proves difficult.

Technology Usage

Computer  Mac
Cell Phone  Samsung
PDA  None
Other  ipod
Primary Device  Desktop
Web Use  Daily
Computer proficiency  Skilled
Applications  Word, LabanWriter, PowerPoint, Excel, itunes
Technical frustrations
Lack of distinction in visual icons, the unwanted use of modes and little knowledge of useful short cuts or capacity to trouble shoot.


Figure 21. Student Persona 01
Dancer

“...”

Personal Details

Name Chris
Age 20
Education Undergraduate Student
Future Occupation Dancer, Choreographer
Attitudes Independent, Creative
Marital status Single
Children None

Dance Knowledge

Notation Systems Labanotation
Styles Modern, Classical, Jazz
Dance Documentation Weekly
Major Contemporary
Laban Frustrations

“...”

“...”

General set-up, symbol editing and positioning can be difficult and made more efficient, particularly the staff set up which could be designed to automatically fit the layout of a page. The presentation of information is displayed in an overwhelming manner making it difficult to find the correct symbol.

Technology Usage

Computer Mac & PC
Cell Phone Motorola
PDA No
Other ipod
Primary Device Laptop
Web Use Daily
Computer proficiency Skilled
Applications Word, LabanWriter, PowerPoint, Excel, itunes
Technical frustrations

“...”


Figure 22. Student Persona 02
concerning the suitability of interaction and interface design artefacts from the viewpoint of an educator, a student, and the designer.

**Persona Needs and Functions**

A number of issues come into play when seeking to determine a balance between user needs and requirements during the development of a product. The subtle negotiation between users’ perceived needs, the purpose of a product, and that which is considered useful or necessary is often different because of the diversity that exists within a particular community of use. This is further complicated by the technological reasoning required to support a variety of needs and requirements that often present themselves as the features of a product. Alexander (1964, p. 24) refers to this balancing act through the notion of “fit” as the absence of “misfits.” This can be described as a process of eliminating the consequences of incompatible design elements that cause “misfits.” I argue that, in search of this fit or unity of form, the appropriateness of a system’s features can be more easily determined if the elements of a system’s concept are first considered as a framework for evaluation. This is opposed to a process of conceiving an explicit set of criteria that by requirement are fulfilled in order to meet the objectives of a system that fail to consider its application to the community for which it is intended.

The characterisation of high-level user functions and prototype features in Chapter Seven, “Initial Design Requirements” provides end-users of the system with a context in which to mutually negotiate and determine a range of system features that could meet these goals. In light of the users’ various needs and requirements, these suggestions can then be contrasted with the high-level usability goals and systems functionality to provide a balance between a user-centred focus and the practicalities of developing the proposed design elements as a unified whole. Drawing on the distinct characteristics of three personas created to guide the design process, the roles of the end-users of the system were divided into two groups (Cooper, 1999). The first group identified as dancers are the primary user audience, while educators signify the second group and are understood as the facilitators of the primary user audience (Don & Petrick, 2003; Preece, Sharp, & Rogers, 2002).

The information captured in Table 5. Persona Needs Chart was determined as a result of
<table>
<thead>
<tr>
<th>Need</th>
<th>ROLE: PRIMARY USER AUDIENCE</th>
<th>ROLE: FACILITATORS</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>dancer</td>
<td>educator</td>
</tr>
<tr>
<td></td>
<td>1 2 3 4 5 6</td>
<td>1 2 3 4 5</td>
</tr>
<tr>
<td>Symbol definitions</td>
<td>✔ ✔ ✔ ✔ ✔ ✔</td>
<td>✔ ✔ ✔ ✔ ✔</td>
</tr>
<tr>
<td>Symbol recognition</td>
<td>✔ ✔ ✔ ✔ ✔ ✔</td>
<td>✔ ✔ ✔ ✔ ✔</td>
</tr>
<tr>
<td>Helpful Laban writing rules</td>
<td>✔ ✔ ✔ ✔ ✔ ✔</td>
<td>✔ ✔ ✔ ✔ ✔</td>
</tr>
<tr>
<td>Score guides</td>
<td>✔ ✔ ✔ ✔ ✔ ✔</td>
<td>✔ ✔ ✔ ✔ ✔</td>
</tr>
<tr>
<td>System for quick writing</td>
<td>✔ ✔ ✔ ✔ ✔ ✔</td>
<td>✔ ✔ ✔ ✔ ✔</td>
</tr>
<tr>
<td>System for complex writing</td>
<td>✔ ✔ ✔ ✔ ✔ ✔</td>
<td>✔ ✔ ✔ ✔ ✔</td>
</tr>
<tr>
<td>Syntax/spell check</td>
<td>✔ ✔ ✔ ✔ ✔ ✔</td>
<td>✔ ✔ ✔ ✔ ✔</td>
</tr>
<tr>
<td>System feedback</td>
<td>✔ ✔ ✔ ✔ ✔ ✔</td>
<td>✔ ✔ ✔ ✔ ✔</td>
</tr>
<tr>
<td>Assistance with scores &amp; timing</td>
<td>✔ ✔ ✔ ✔ ✔ ✔</td>
<td>✔ ✔ ✔ ✔ ✔</td>
</tr>
<tr>
<td>Assistance with twists &amp; turns</td>
<td>✔ ✔ ✔ ✔ ✔ ✔</td>
<td>✔ ✔ ✔ ✔ ✔</td>
</tr>
<tr>
<td>Assistance with jumps</td>
<td>✔ ✔ ✔ ✔ ✔ ✔</td>
<td>✔ ✔ ✔ ✔ ✔</td>
</tr>
<tr>
<td>Assistance with floor plans</td>
<td>✔ ✔ ✔ ✔ ✔ ✔</td>
<td>✔ ✔ ✔ ✔ ✔</td>
</tr>
<tr>
<td>Motif Symbols</td>
<td>✔ ✔ ✔ ✔ ✔ ✔</td>
<td>✔ ✔ ✔ ✔ ✔</td>
</tr>
<tr>
<td>Embody movement</td>
<td>✔ ✔ ✔ ✔ ✔ ✔</td>
<td>✔ ✔ ✔ ✔ ✔</td>
</tr>
<tr>
<td>Glossary</td>
<td>✔ ✔ ✔ ✔ ✔ ✔</td>
<td>✔ ✔ ✔ ✔ ✔</td>
</tr>
</tbody>
</table>


Table 5. Persona Needs Chart
expert interviews and an interface recognition questionnaire (see Figure 23. Interface Recognition Questionnaire), completed by students during a user-focused workshop. It represents the needs of five educators who facilitate the learning and practical application of Labanotation through dance notation applications. This is accompanied by the elements six dancers, all novice users of Labanotation, deemed necessary to facilitate the ease of use and accessibility of Labanotation. To reduce the potential bias brought to this process by Labanotation educators, the suggestions they made in the formative evaluation of persona needs were considered as fundamental requirements of a system in most instances. Table 6. Persona Needs and Features Chart illustrates both the shared and individual needs of the user groups, which were then aggregated. Findings in the Persona Needs and Features Chart illustrate the user preferences for each need, which are associated with various product features relevant to the practise of Labanotation and the functionality of the system. In this way, common goals and shared needs across the design of a prototype application are made explicit. These facilitate the greater accessibility of Labanotation scores, which may be effectively utilised by various members of the dance community for both general and specific purposes.

Use Case Scenarios

Use case scenarios provide designers with a technique in which descriptive accounts of a variety of user actions can be obtained (Preece et al., 2002). This is before any product development has commenced, and is a practical way to gain insight into the types of interaction required for implementation into a proposed product. These accounts or stories can reveal potential conflicts and issues between the different ways in which individuals think, act, and work within a given set of circumstances. The information that scenarios provide are not taken as a rule of prescription for the design of interaction, but work as a guide towards developing a rationale for the design of systems interaction (Benyon, Turner, and Turner, 2005; Preece et al., 2002). Understanding the scope for variation is critical to the design of a structure that facilitates the artistic expression of movement. Not only is a description of movement unpredictable, but it also contains an unlimited potential for variation in the circumstances surrounding the use of a product or system that supports its expression and documentation as ideas in action. Therefore, the purpose of this user study was to understand, refine, and enhance the technique of notating movement in dance notation.
Figure 23. Interface Recognition Questionnaire
<table>
<thead>
<tr>
<th>Need</th>
<th>Neutral</th>
<th>Recommended</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>dancer</strong></td>
<td><strong>educator</strong></td>
<td></td>
</tr>
<tr>
<td>Symbol definitions</td>
<td>Symbol Inspector: Symbol</td>
<td>✔️</td>
</tr>
<tr>
<td>Symbol recognition</td>
<td>Symbol Inspector: Measure</td>
<td>✅</td>
</tr>
<tr>
<td>Helpful Laban writing rules</td>
<td>Laban Reference Library</td>
<td>✔️</td>
</tr>
<tr>
<td>Score guides</td>
<td>Various Score guides</td>
<td>✅</td>
</tr>
<tr>
<td>System for quick writing</td>
<td>Motif Laban Staff</td>
<td>✔️</td>
</tr>
<tr>
<td>System for complex writing</td>
<td>Future Development</td>
<td>✅</td>
</tr>
<tr>
<td>Syntax/spell check</td>
<td>Motion Viewer</td>
<td>✔️</td>
</tr>
<tr>
<td>System feedback</td>
<td>Visual System Feedback</td>
<td>✔️</td>
</tr>
<tr>
<td>Assistance with scores &amp; timing</td>
<td>Staff &amp; Measure Set-up</td>
<td>✔️</td>
</tr>
<tr>
<td>Assistance with twists &amp; turns</td>
<td>Movement Editor: Supports</td>
<td>✅</td>
</tr>
<tr>
<td>Assistance with jumps</td>
<td>Movement Editor: Supports</td>
<td>✔️</td>
</tr>
<tr>
<td>Assistance with floor plans</td>
<td>Movement Editor: Orientation</td>
<td>✔️</td>
</tr>
<tr>
<td>Motif Symbols</td>
<td>Future Development</td>
<td>✔️</td>
</tr>
<tr>
<td>Glossary</td>
<td>Glossary/Future Development</td>
<td>✔️</td>
</tr>
</tbody>
</table>


**Table 6. Persona Needs and Features Chart**
applications. Use case scenarios that assist the identification of specific user preferences in task-based operations were created to better understand the way in which students conceptualise, compose, and shape the process of giving form to creative ideas as symbols on a score.

The development of use case scenarios with Labanotation students provided a practical way to gain a firsthand insight into the fundamental steps and necessary tasks involved in notating movement for novice users of Labanotation. This involved six students at an introductory level who were asked to describe and write in the plain English associated with the verbal vocabulary of Labanotation the process of notating a specific sequence of movement. Provided with an identical Labanotation score, each student was asked to describe the precise manner in which they would create the exact same score if assisted by a computational support tool (see Figure 24. LabanAssist Notation Task and Figure 25. User Scenario for the initial documents).

The results of the use case scenarios illustrate that students describe and document movement based on their prior knowledge and experience with using the notation application LabanWriter. One use case scenario went so far as to include a description of the functional shortcuts and tools used within the system to notate and modify symbols. Despite this, the scenarios demonstrated a variety of ways in which a Labanotation score can be set up, and the systematic manner in which movement can be effectively documented. Furthermore, students established repetitive structures and patterns in their scenarios to reduce the quantity of descriptions required to define the attributes of individual Labanotation symbols. The level of detail, the grouping of symbols, and the use of repetition in these descriptions provided a likely indication of a system for the classification of Labanotation symbols and the manner, steps, and procedures required to complete the task of describing movement for its documentation.

The order in which students chose to notate “supports” and “gestures” further suggests that there exist two distinct approaches to the description and documentation of movement. As suggested earlier in the Expert Interviews, these approaches vary from one another due to personal preferences and individual ways of thinking, acting, and working. One manner of describing movement followed a noticeably horizontal pattern, where a complete description of each movement position was documented before
Figure 24. LabanAssist Notation Task
**Figure 25.** User Scenario

How would you describe the process of notating this movement?

For example: 1) Begin with the staff set up. 2) Create four measures of 3/4 timing. 3) Notate the foot supports in place middle, 4) Add the arms, place low, 5) add the room direction……...

Please describe in your own words (be brief):

1)  

2)  

3)  

4)  

5)  

6)  

7)  

8)  

9)  

10)  

11)  

12)  

13)  

14)  

15)  

16)  

17)  

18)  

19)  

20)  

21)  

22)  

23)  

24)
continuing to the next. This included a description of both “supports” and “gestures” relevant to the duration or time of its performance. The other took shape as a vertical pattern in which the “supports” for an entire measure of movement preceded the description of its corresponding “gestures” for the same measure, and vice versa. Both the horizontal and vertical patterns described are illustrated in Figure 26. Horizontal and Vertical Patterns for the Description of Movement. On occasion, the descriptions provided by the use case scenarios contained minor oversights whereby students mistakenly identified and described leg gestures as arm gestures. The development of use case scenarios offered a useful approach to understand and consider user needs and requirements from the perspectives of both the potential user and the facilitators of notation applications. This highlights the differences between the actual novice user and the experts’ collective understanding of novice user requirements.

Figure 26. Horizontal and Vertical Patterns for the Description of Movement

Research outcomes developed from the creation and analysis of use case scenarios provided a basis upon which an operational structure for notating movement within the prototype LabanAssist was designed. This was achieved through the design of a “Movement Editor,” which is discussed further in “Conceptual Design” and “The
Movement Editor” sections. It is an interface artefact that assists learners of Labanotation to compose Labanotation scores creatively through the flexibility it offers in the selection and description of movement. This is in opposition to the principle that enforcing a fixed order and process for the documentation of movement must be strictly followed by an end-user to be effective. This interface artefact was an outcome of user research that that highlighted two distinct styles in which movement can be documented. These user research outcomes demonstrated that it was necessary to devise a system in which both approaches may be appropriately accommodated.

Card Sorting

Card-sorting techniques can be used to create and evaluate proposed hierarchical structures for task-based operations and interactions (Nielsen, 2004). They are particularly useful when conventional grammar rules of a language offer little assistance in supporting the application of complex symbolic writing systems to original forms or structures of movement descriptions. A group of six students were given a card-sorting activity. This functioned as a means to find a common order to the structures and patterns different people create when asked to organise and prioritise information. The arrangement and categorisation of the information contained within these cards was based on the model for interaction discussed in Chapter Seven, “A Framework for Interactivity,” and knowledge gained from the outcomes of the expert interviews (see Figure 27. Interface Cards).

To begin this activity, students were asked to imagine that they needed to notate a step forward on the right foot that then held the weight of the body in this position. With this in mind, they were asked to examine the five cards pictured in Figure 27. Interface Cards, and arrange them in an order that would enable them to describe the elements of a step forward. Additionally, they were asked to circle any items in the design of the interface represented on the cards which they found to be confusing. While the cards were primarily used to determine a structure for organising movement, the early visual design concepts were also assessed for their ability to communicate task objects and actions (discussed in Chapter Seven, “Mapping Interface Objects and Actions”) that were both recognisable and successful in facilitating a description of movement.
Figure 27. Interface Cards
Two additional questionnaires that evaluated the identification of interface icons, interface design artefacts, and other suggestions were conducted at the same time (see Figure 23. Interface Recognition Questionnaire and Figure 28. Interface Design Questionnaire).

Results of the card-sorting procedure demonstrate that not one of the participants describes or thinks about movement in the same way. The arrangement of the five cards used in this activity presented a possible one hundred and twenty different ways of ordering information pertaining to movement; all relevant to the description of a step forward as described earlier. The formula for the arrangement of a single set of five cards was exponential and calculated as $5 \times 4 \times 3 \times 2 \times 1 = 120$, to represent the possible combinations of movement descriptions. These findings emphasise the difficulty and complexity involved in sequencing and organising movement for its description. For that reason, LabanAssist is confined to a basic understanding of movement, and makes use of an introductory level of Labanotation symbols and possible movement options for the documentation of movement.

**Task Analysis Workshop**

The purpose of the task analysis workshop was to create a broad system structure for the documentation of movement (Preece et al., 2002). This was an important step in the inquiry, given the results of the above card-sorting activity. The broad system structure is one in which the diverse array of approaches users think about, create, and actually document movement will be accommodated. Six students assisted in the design of a variety of choices capable of facilitating the numerous ways in which movement can be documented. At a foundational level, this was achieved by collaboratively exploring the process and arrangement of the elements necessary to describe movement.

The task analysis workshop involved two groups of three students, who collectively developed, discussed, and mutually agreed upon a system structure that could facilitate a basic description of movement. This analysis was based on the students’ shared knowledge of Labanotation, and their needs in relation to their level of understanding. As a result, this approach assisted in determining a suitable degree of difficulty in the design of a system that complements the skill level of its potential users.
Is it clear that there are different layers on the score?: Yes / No

Are the columns easy to identify?: Yes / No

Is the background colour easier to see than the background?: Yes / No

Would this grid make it easier to position symbols on the score?: Yes / No

Do the background lines make the columns easier to see?: Yes / No

Is this clearer than the colour background?: Yes / No

Does the background colour make the columns easier to see?: Yes / No

Would this grid make it easier to position symbols on the score?: Yes / No

Figure 28. Interface Design Questionnaire
The workshop required the designer to act as a group facilitator, and lead the early modelling of unstructured tasks. The functional requirement for this particular modelling task was to create a structure for the documentation of movement. In two distinct groups, participants were encouraged to collaboratively organise elements of the description of movement in a coherent form or structure relevant to the practise of Labanotation. Participants were required to propose a starting point for the description of movement and define the subsequent elements of the description to create a complete task structure. During the development of each task structure, students were also required to articulate the reasoning behind their suggestions. A working model of each task analysis schematic was visually mapped using note cards to illustrate these suggestions (see Figure 29. Working Task Analysis Model). This enabled the sequencing of information or movement tasks to be made explicit. Discussions concerning the sequencing of elements that students found necessary to describe movement were also included in this model. These discussions were documented as individual claim, and provide the underlying rationale for and against the particular construction of the suggested task structures.

Figure 29. Working Task Analysis Model

In the development of this research, two groups of three students developed separate task analysis schematics (see Figure 30. Group One Task Analysis and Figure 31.
Group Two Task Analysis). These were later combined to illustrate the number of
participants that argued for the ordering of a specific task, illustrated in Figure 32.

Design Rationale. The final design rationale schematic presents a number of persuasive
arguments that shape new ways in which design products that serve innovative purposes
can be created. Furthermore, it provides the underlying rationale for the design of
interaction and interface artefacts for their implementation in the prototype application
LabanAssist.

These schematics offer a means in which a group can mutually discuss, understand, and
illustrate the prioritisation of elements they give to the formation of movement
descriptions. Each group of participants agreed that the information presented in the
schematic they developed afforded them the necessary flexibility to describe movement
in a manner that reflected the way they thought about its composition. The comparative
analysis of the schematics developed, therefore, influenced the design of a hierarchical
structure and the arrangement of specific movement constructs. This included the
information they contain to facilitate the description of movement in an interactive
environment.

The results of this analysis further support the previously found (discussed in this
chapter, above, in “Expert Interviews”) understanding that there exists two distinct
ways in which students think about and describe movement. This can be from a general
description of movement to the specific, and vice versa. A general description involves
obtaining an overview of the movement to be performed, and then creating a structure
in which the nuances of movement may be added. In this way, a student would most
likely create a time structure and a floor plan to provide a framework for capturing a
more detailed description of movement. As an alternative, a specific description of
movement could involve setting up a time structure that continues with the specification
of body parts. This allows for a direct understanding of the physical attributes of the
movement being described. Fundamental to understanding Labanotation is that it is
written on vertical staffs that are divided into columns (see Figure 33. Supports and
Gestures Columns). Therefore, this approach closely follows the process of notating
movement upon a Labanotation staff. This can start at its innermost columns, called the
supports columns, and then progressively work to the outermost columns (Ann
Hutchinson Guest, 2005). For this reason, the design of interface artefacts and their
Figure 30. Group One Task Analysis
Floor plans are a part of the set up process before movement is described. Floor plans precede the documentation of orientation signs. Floor plans are a way to finalise the description of movement.
Figure 32. Design Rationale
capacity for interaction must remain flexible to users so they can accommodate these differences and variations in the description of movement. These alternatives are illustrated in the second level of hierarchy in Figure 32. Design Rationale.

**Design Rationale**

This research identifies the complexity involved in understanding and planning the design of a system to accommodate a variety of possibilities in which movement can be described for its documentation. It illustrates the fundamental difficulties novice users of Labanotation encounter when learning its symbolic language. Knowledge of these difficulties was developed collaboratively with Labanotation students and experts to better address the necessary requirements for the design of a system for novice use. The above-mentioned techniques, interviews, and student-led workshop facilitated the development of the underlying design rationale for the development of LabanAssist.

The outcomes of this research suggest that specifying the timing and measure of a score as the first task of documenting movement supports the premise that time and/or rhythm provide a basic structure for the description of movement. It also suggests that specifying a body part as a support or gesture, following the creation of a measure, is a sound method for describing movement that aligns itself to the practise of Labanotation. In this way, a system of describing movement that begins with identifying weight-
bearing movement, which is documented in the innermost support columns of a Labanotation staff and works in a sequentially outwards manner, subscribes to the practise of constructing Labanotation scores. This forms a direct relationship to the specification of body parts in relation to their positioning along the columns of a Labanotation staff.

In general, the use case scenarios endorse the finding that students describe supports or weight-bearing movement before that of non-weight-bearing movement or gestures. Furthermore, this was discussed and generally agreed upon among participants of both focus groups as a fundamental approach to notating movement. However, equally as important as the specification of moving body parts is the need to continue or finalise the process of structuring an all-encompassing description of movement. This can be achieved through the creation of a floor plan, which provides a general overview of the direction and orientation of a performer throughout a sequence of movement via a linear plan. In this way, an understanding of the basis or structure of movement may be captured to enable the addition of more specific details of movement such as the body parts to be described.

Participants involved in this research all conceived, described, and documented movement in different ways. Despite this, there are strong parallels between the way students think about and verbally describe movement and the manner in which they create Labanotation scores. The significance and prioritisation of terms proposed to represent key elements of movement descriptions in the tasks analysis schematics provides an association between the ideational formation of movement and a structure for the composition of Labanotation. This is without explicit reference to the formal grammar rules of Labanotation because, as we have seen, illustrated throughout the various inquiries described and discussed above there is the potential for many structural variations in the most basic descriptions of movement. While the variety for this is considerable, it is envisaged that the conception of movement and the terms in which they are conceived can transform creative ideas into an expression of formal language when facilitated by a tool that leverages this association.

Identifying user tasks and actions early in the design process assists the designers capacity to develop useful and useable interfaces equipped to facilitate specific user
needs and requirements. Holding tentative opinions and welcoming the perspectives of Labanotation experts and students alike in the development of this research enabled a wider range of suggestions for the design of the prototype to be considered. The benefit of this facilitated an approach to describing and documenting movement that caters to various user needs and requirements. Utilising ideas and suggestions from novice and expert users of the language outside the range of an individualistic understanding of the design situation enhanced the potential for the variety and scope of functional and visual design elements of LabanAssist to be developed. This suggests that, in situations where a feeling of mutual involvement exists among communicating equals, an understanding for new knowledge can be developed (Barnlund, 1979). Understanding the various techniques used to support and inform the design and interaction of user interfaces is also fundamental to the overall success and effectiveness of a product’s iterative development (Ebenreuter, 2006).

**Conceptual Design**

The rationale developed for the design of the proposed prototype application worked to assist the early conceptual design of LabanAssist. This was achieved because in an attempt to alleviate the complexity involved in the documentation of movement and to address the specific problems identified above; a number of visual design concepts were created (see Figures 39–45: Interface Design Concepts). The impact of the design rationale is best illustrated by the visual design documentation created as a result of various decisions made in the early stages of this research.

In the following research I make explicit a number of resulting decisions that support the design of specific interactive functions within LabanAssist. This is achieved by providing a descriptive account of the relationship between (1) the specific problems found in the practical application of Labanotation; and, (2) the design artifacts created to overcome these issues. I then further support the first two points with, (3) an explanation of how the function of the design outcome operates; and corresponds to, (4) the visual attributes found in the interface design of the proposed artifacts. In doing so, I seek to illustrate how user-centred and participatory design research can have a direct impact on the knowledge a designer has of the elements of a design situation. In particular I give focus to the way in which the knowledge garnered from the above-
mentioned research practices informs the act of designing. This is highlighted when the
decisions made during the conceptualisation of a product are supported by a rationale
for its design.

The details of specific design decisions made during the conceptual design of the
prototype application LabanAssist include:

1. **Symbol definition**
   - **Problem:** It is difficult for novice users of Labanotation to make use of its
     symbolic language without knowledge of the information it represents.
   - **Design Artifact:** The design of a symbol tab within the Symbol Inspector
     should give focus to the visual representation and descriptive attributes that
     Labanotation symbols contain.
   - **Functional Explanation:** The symbol tab in the Symbol Inspector should assist
     the visual display of information regarding individual Labanotation symbols for
     the purpose of study and analysis. It should also enable end-users to edit, delete
     and access further theoretical information with regard to selected Labanotation
     symbols.
   - **Visual Design Concept:** The symbol tab in the Symbol Inspector should list the
     key attributes of a Labanotation symbol that is selected on a score (through the
     functionality of the Score Editor). It should provide a correlation between a
     symbol’s position on a score and the basic shape of the selected symbol in an
     isolated view. See Figure 34. Symbol Definition.

![Figure 34. Symbol Definition](image-url)
2. Symbol recognition

- **Problem:** Labanotation symbols are difficult for novice users of Labanotation to recognize and distinguish from one another on a score.

- **Design Artifact:** The design of a measure tab within the Symbol Inspector should provide contextual information concerning the composition of Labanotation symbols. It should assist with the identification and interpretation of individual and collective Labanotation symbols on a score.

- **Functional Explanation:** The function of the measure tab should provide end-users of LabanAssist with the ability to select and display information regarding the relationship of a single symbol to other surrounding symbols in a measure of movement.

- **Visual Design Concept:** The measure tab in the Symbol Inspector should illustrate the information Labanotation symbols contain by way of a 3D human figure representation and informative descriptions. Various parts of the body that the Labanotation symbols represent should correspond to color-graded information regarding the contextual information Labanotation symbols represent on a score. See Figure 35. Symbol Recognition.

![Figure 35. Symbol Recognition](image)

3. Error detection

- **Problem:** Detecting errors in Labanotation scores is difficult for novice users of the language who are not yet able to read and interpret scores.

- **Design Artifact:** The Motion Viewer should provide an avenue in which end-users of LabanAssist can detect errors in their scores through the visualisation of Labanotation to animated movement.
• **Functional Explanation:** The Motion Viewer should enable users to visually assess notated scores for potential errors in their composition via the translation of Labanotation to animated movement. This should be made possible via the functionality of the playback head in the Score Editor, which corresponds to the movement visualised in the Motion Viewer. General playback controls located within the Motion Viewer interface artifact should also facilitate this type of integrated interactivity.

• **Visual Design Concept:** The playback head located in the Score Editor should illustrate the area of the score, and the Labanotation symbols that are translated to animated movement in the Motion Viewer. This should provide end-users of LabanAssist with a visual cue as to the relationship between notated symbols on a score and the movement they represent. See Figure 36. Error Detection.

![Motion Viewer](image)

**Figure 36. Error Detection**

4. Complex grammar rules

• **Problem:** It is difficult for novice users of Labanotation to document movement without knowledge of the different grammar rules of Labanotation.

• **Design Artifact:** The design of a Laban Reference Library should enable novice users of Labanotation to actively experience the practice of creating Labanotation scores with the ability to reference specific rules and conventions of the language.
• **Functional Explanation:** A Laban Reference Library should be designed to provide contextual help to those that access the library. When accessed the reference material provided should be specific to the interactive situation at hand.

• **Visual Design Concept:** The Laban Reference Library illustrates theoretical information concerning the use of general and particular Labanotation symbols. It displays the title of the symbol and the information it contains. This is represented as red in a human figure illustration. The reference material should also provide a description of how the symbol can be used in a number of instances to describe movement. See Figure 37. Grammar Rules.

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[Diagram of Laban Reference Library]

**Figure 37. Grammar Rules**

5. **Score Guides**

• **Problem:** It is difficult for novice users of Labanotation to position Labanotation symbols on a score. This involves the positioning of a symbol in the correct column of a score and to also specify the indented duration of notated movement.

• **Design Artifact:** The design of visual guides within the Score Editor should give clarity to the areas in which symbolic information concerning the duration of movement and particular parts of the body can be specified on a score.
• **Functional Explanation:** The function of the score guides within the Score Editor should enable end-users of LabanAssist to select a preferred method of visually illustrating the divisions of a staff on a score.

• **Visual Design Concept:** The function of highlighting various attributes of a Labanotation score, by way of visual guides, should work to emphasise the division of a staff’s columns on a score. Horizontally, to identify the body part of a movement and vertically, to indicate the duration of movement by the height of a symbol on a score. In doing so, these visual guides should aim to assist the understanding of the various locations in which Labanotation symbols can be positioned. Descriptive text labels identifying each column below the score should further complement the visual interface of the Score Editor. See Figure 38. Score Guides.

![Figure 38. Score Guides](image)

6. **System feedback**

• **Problem:** It is difficult for novice users of Labanotation to know when and how to use general or particular symbols to describe movement.

• **Design Artifact:** Descriptive error messages should provide the end-users of
LabanAssist with useful information as to how they may proceed with the process of documenting movement.

- **Functional Explanation:** Visual system feedback in the form of context specific information panels should appear automatically when end-users of LabanAssist attempt to describe movement that is either anatomically impossible or for movements that can be documented using a variety of particular or general symbols.

- **Visual Design Concept:** An error message panel should open up in front of the general interface for LabanAssist in order to call attention to the potential problems that may occur under the current state of interaction. In addition to this, the interface artifact should offer end-users the choice to either continue or abandon the current course of interaction. See Figure 39. System Feedback.

![Figure 39. System Feedback](image)

7. Score structure

- **Problem:** Novice users of Labanotation have difficulty in specifying a score’s time structure.

- **Design Artifact:** A new score setup assistant should offer end-users of LabanAssist the option to create generic staves and to also specify different elements of the score’s time structure.

- **Functional Explanation:** The function of the setup assistant should enable users to select particular time structures and music tempos during the creation of a new score.

- **Visual Design Concept:** During the selection of a number of different attributes that make up a score’s structure, each modification to a basic score structure should be visualised in the preview window of the setup assistant (See Figure 40a. Score Structure). In this way the tempo and measure of movement may be
better understood in relation to the structure and formatting of a score (See Figure 40b. Score Structure).

![Figure 40. Score Structure](image)

8. Rotating Movement

- **Problem:** Knowing how to modify movements to twist and turn with regard to various body parts and the spatial environment, is difficult for novice users of Labanotation.

- **Design Artifact:** Attributes within the Movement Editor should supply users with the ability to specify different types of twists and turns. This is both with regard to the spatial orientation of a performer and individual parts of the body.

- **Functional Explanation:** By selecting various options within the supports, gestures and orientation tabs in the Movement Editor end-users of LabanAssist should be able to specify the basic rotation and twists of various limb positions they wish to document.

- **Visual Design Concept:** The orientation tab within the Movement Editor should visually illustrate the spatial orientation of a performer with regard to the direction a performer faces and their position in a room (See Figure 41a. Rotating Movement). The symbols for the selected attributes and their composition on a score should also be made visible. It is envisaged that greater
functionality will be developed for the documentation of turns within the supports tab (See Figure 41b. Rotating Movement).

Figure 41. Rotating Movement

9. Aerial Movement

- **Problem:** Documenting aerial movement to match a particular tempo is difficult for novice users of Labanotation. This is because aerial movements can be indicated by the lack of a Labanotation symbol on a score, which can precede the beginning of a score’s main content in some instances.

- **Design Artifact:** Particular attributes within the Movement Editor should provide a number of options with which to specify aerial movement. This should also include the ability to document the return of aerial movements to the ground plane.

- **Functional Explanation:** The addition of an upbeat in the measure tab should support the documentation of aerial movement that begins before the first beat of movement. By selecting this option it should be possible to describe the landing of an aerial movement in the first beat or bar of the score.

- **Visual Design Concept:** The measure tab in the Movement Editor should illustrate the visual relationship of the timing of an upbeat with regard to its documentation on a score (See Figure 42a. Aerial Movement). Greater functionality will be developed for the documentation of aerial movement or
jumps within the supports tab (See Figure 42b. Aerial Movement).

**Figure 42. Aerial Movement**

Illustrating the individual and specific conceptual design decisions for how the preliminary interaction and interface design for LabanAssist should be provides a foundation for the design of the prototype application. Moreover, this foundation is one that is firmly grounded in the problems particular to the practical application of Labanotation. As a result of the designer’s active involvement in user-centred and participatory design practices students and experts of Labanotation found the above-mentioned issues to be challenging to the documentation of movement as Labanotation scores. The benefit of this research underpins the value of end-user involvement early on in the design process and how information acquired from user-centred and participatory design practices can be made explicit to inform the decisions made in the conceptual design of a product.

**Transform**

Unification as a guiding principle for the design of the prototype application LabanAssist, as discussed in Chapter Seven, “Initial Design Requirements,” has guided its development. This is in conjunction with a greater understanding of user needs and the diversity required in order to facilitate both the objectives of the system and its end-users. A strong sense of how the various parts of the design situation will contribute to a
unified whole gives support to the informed intuitions a designer has with regard to the necessities of design that a product demands. This understanding gives way to a knowledge that informs the rationale behind the creation and realisation of design artefacts and products. Judgements made as a result of this knowledge form the basis for the way in which the interaction of a system will function, and how the design of an interface will support the purposes of this functionality.

Therefore, this research examines how interaction and interface artefacts can be appropriately designed to structure complex information and allow for diverse user situations. It illustrates how design principles shape the development of design artefacts that facilitate structured interactions for useful productive purposes. However, the structure for this interaction is not static. It is essentially dynamic and contributes to the changing conditions of form and matter in the documentation of Labanotation scores. This also takes into consideration the progressive development of end-users’ practical application and understanding of the language.

Through a play of tropes represented as broad terms in the design of an interface, individuality and diversity can enter into the experiences of others during the practise of notating movement as Labanotation scores. As a result, thought is transformed from the figurative formation of ideas to a symbolic description of movement. This is achieved through the facility of LabanAssist and user interactions in the creation, composition, and subsequent concrete representation of movement as a Labanotation notation score. Significant to this interaction is the interrelation of forms (Burke, 1975), where elements of interaction found within various interface artefacts necessarily work together in principle and utility to reach a common goal.

The various forms of independent artefacts should work in concert to assist a comprehensive approach to the use, interpretation, amendment, and documentation of Labanotation scores. This is achieved through the design of interface artefacts that utilise types of conventional, minor, repetitive, and progressive forms of interactivity that underpin the practises of Labanotation (Burke, 1975). I discuss the principles behind the design of the artefacts created for LabanAssist and their functionality throughout the remainder of this chapter. The realisation of the following interface
The Design of Interaction

As discussed in Chapter One, “Design Purpose,” working solutions that seek to address the limitations found in the interaction and translation of Labanotation for computer-generated animation have typically involved collaborations. These collaborations have contributed to the mechanistic and technological development of a number of movement-related computer applications. They include researchers and developers with backgrounds in computer science, dance notation, movement analysis, and dance-related disciplines (Badler & Smoliar, 1979; T. Calvert, I. Fox, R. Ryman, and L. Wilke, 2005a; Fox, Marion, & Venable, 2004; Neagle, Ng, and Ruddle, 2004; Ryman, 2001). The focus of interaction design is, however, centred on the planning and organisation of possible human interactions for diverse productive outcomes. This interaction is between a system and user. Rather than place an emphasis on the capacity of technology in order to support specific functions that shape interactivity, the design of interaction seeks to alleviate complex computer interactions. Thus, end-users of a system will be able to develop an idea that can be expressed with the assistance of technology. This is relevant where an idea is understood as the organising principle behind the choice and development of the interactivity that is required to describe movement (Burke, 1969). This is also in opposition to the utility of interaction often bound by fixed structural constraints because of technological limitations, or lack thereof, which can either cause stale and rigid interactions or chaos and confusion.

The premise that form and matter as an integrated, organised whole is essential to the formation of effective design products. Adherence to this premise will rule out the potential for extreme cases of enforced or unrestrained systems design, where such potential would be consequential to user interaction and productive outcomes. If we accept that “structural hierarchy is the exact counterpart to functional hierarchy” (Alexander, 1964, p. 131), then we can form the basis of an argument that supports the principle that the structure of content provides form with a functional purpose. This is where content is understood as the structured integration of Labanotation symbols (matter) on a score (form) that will have the capacity to communicate in a coherent form.
**Figure 43.** Interaction Design Application Mode and Template Selection
**Figure 44. Interaction Design New Score Setup**

<table>
<thead>
<tr>
<th>02.1 Staff</th>
<th>02.2 Measure</th>
<th>02.3 Floor Plan</th>
<th>02.4 Glossary</th>
<th>02.5 Layout</th>
</tr>
</thead>
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<td>Measure</td>
<td>Floor Plans</td>
<td>Glossary</td>
<td>Layout</td>
</tr>
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<td>0</td>
<td>Select</td>
<td>place at bottom</td>
<td>place at bottom</td>
<td>Staffs Per Page</td>
</tr>
<tr>
<td>1 - 6</td>
<td>beats per measure</td>
<td>place on right</td>
<td>place on right</td>
<td>0</td>
</tr>
<tr>
<td>Upbeat</td>
<td>tempo</td>
<td>none</td>
<td>none</td>
<td>0 - 6</td>
</tr>
<tr>
<td>off</td>
<td>2/4, 3/4, 5/4, 6/8</td>
<td>none</td>
<td>none</td>
<td>Center align score items</td>
</tr>
<tr>
<td>on</td>
<td>adagio, largo, lento, moderato, allegro</td>
<td>none</td>
<td>none</td>
<td>on</td>
</tr>
<tr>
<td>on</td>
<td>none</td>
<td>none</td>
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**Details & Items**

Function: New Score Setup

Version: 1.0

Date: 10.03.07

Task Level: Beginner
Figure 46. Interaction Design Score Editor and Motion Viewer
Figure 47. Interaction Design Symbol Inspector
Figure 48. Interface Design Startup
This time signature is commonly used for waltzes and scherzi.
Figure 50. Interface Design LabanAssist Basic
Figure 51. Interface Design LabanAssist Intermediate
Figure 52. Interface Design Artifacts
Figure 53. Interface Design Tool Bar
Figure 54. Interface Design Menu Items
Scores need to adhere to the discipline and grammatical structure of the language. Without this discipline, a structure for the content of Labanotation, the form of Labanotation symbols on a score, is unintelligible. Furthermore, such scores are unable to provide a useful purpose in the preservation of dance culture for they are unable to communicate knowledge of their art if they cannot demonstrate the unity of form that gives significance to their composition. This is illustrated by the lack of order maintained within the notation editor LabanWriter (see Figure 55. LabanWriter Score), where the random positioning of Labanotation symbols on a score leads to the decay of form and content, which is vital to realise fully the function in which they communicate. Therefore, without an underlying structure to support the functionality necessary to support the correct syntactical and grammatical creation of Labanotation scores, the capacity of the product LabanWriter is unable to provide its end-users with purposeful interactions that sustain the long-term reading, writing, and creation of Labanotation scores.

Figure 55. LabanWriter Score
The careful ordering and arrangement of matter as Labanotation symbols is required to maintain the purpose and usefulness of a product. This will not only ensure the precise composition of Labanotation scores, but will also support an understanding of the practise of Labanotation to develop and enhance the user experience. By drawing on the structures developed above in the “Task Analysis Workshop,” this is achieved in a way that facilitates the progressive development of Labanotation scores, as form, to unfold in a qualitative manner that reflects the practical use of this tool. Singh et al. (1983) maintain that a well-designed system of interactive dialogue between system and user can increase user thinking. Therefore, the integration of an operational structure for the composition of Labanotation; and an interface that communicates the potential relationships between a number of movement concepts to guide interactivity; will enhance the way users think about documenting movement, and will support the correct syntax of score creation (Ebenreuter, 2005).

The key objective of the interaction design component in the prototype application LabanAssist is to simplify the process of score creation for those with little knowledge of the intricacies of Labanotation. It works to assist with the correct grammatical composition of Labanotation scores, and to support the identification of Laban symbols for novice users of the language. It requires end-users of the system to select various terms, through menu options and items, in the interface to create a description of movement for its documentation. In doing so, it removes the need for a purely technical solution for verification of the structure and syntax of Laban symbols when manually positioned on a score. This is achieved by the direct manipulation of individual symbols.

Communication is important to the progress of documentation. Communication, in this context, refers to a type of conversation between user and system for the development of creative ideas. By designing an operational structure for the documentation of Labanotation scores, and an interface that encourages communication, the correct syntax of dance notation is established as a function of the system.
Transformation to the Interface

A visual interface that supports the potential for communicating the range of interaction possible during the process of documenting movement is essential to the usefulness and usability of a product. To assist this communication, visual representations that illustrate associations between language and thought as Labanotation symbols and animated movement will help. They achieve this by communicating elements of identification, choice, significance, and action. However, it often becomes challenging for a designer to integrate these associations into a digital environment when the elements of choice; that is to say Labanotation symbols; are difficult for users to identify and interpret.

Primarily, notation languages are symbolic languages (Brown and Smoliar, 1976; Ann Hutchinson Guest, 1977). It is widely acknowledged that notation systems are inherently complex to use. This is because symbols do not explicitly represent the objects they depict, and require knowledge of their convention to understand and use effectively. The visual and descriptive capacity of notation systems to provide a detailed description of movement or an insightful visual aesthetic are two elements that dictate their form, identification, and subsequent use. Therefore, the difficulties students face in comprehending the fundamentals of dance notation systems (Yasuda, 2001) have been attributed to the knowledge required to interpret these symbolic systems.

Abstract notation systems such as Labanotation provide a rigorous description of movement (Ann Hutchinson Guest, 1989). It is argued that this is done at the cost of encompassing a comprehensive range of movement (Barbacci, 2002; Lansdown, 1995). This is unlike pictorial notation systems, which illustrate movement more clearly to the untrained viewer through its graphic symbols. Novice users of abstract systems find that, as a consequence, the symbolic language of Labanotation appears at odds with the objects or movement it represents and is, as a result, not easily interpreted. For this reason, the semiotic value or surface structure of Labanotation symbols offer little assistance in communicating knowledge of their meaning. This poses distinct challenges for novice users of the language by requiring users to individually identify and select specific Labanotation symbols in order to create scores of movement.
It is, therefore, important to understand fully the principle that tropes as poetic constructs work to orient conceptual thought and open up the potential for a variety of concrete possibilities. For the purposes of this research, the representation of broad terms in an interface; those that follow the verbal vocabulary of Labanotation; do so to facilitate the transformation of an arbitrary description of movement to generate new possibilities. Drawing on the theory of transformational grammar (Chomsky, 1977) discussed in Chapter Seven, “The Boundaries of Grammar,” the idea or concept behind a description of movement may be represented symbolically in an interface as a result of interactivity. This is achieved thorough the selection of any possible combination of terms that contribute to the formation of movement, and are illustrative of the idea or thought that lies behind their expression. As an available resource, this is useful where the abstract verbal terminology of Labanotation works to assist the poetic construction of movement (discussed in Chapter Two, “Symbolic Communication”) that has not yet been fully imagined or experienced, so that it can be described and documented as Labanotation scores. The use of this terminology assists this process by offering a starting point from which to generate a description of movement. This is based on the selection of broadly termed descriptions of movement that follow the practise of composing Labanotation scores, and are relevant to the physical positioning and attributes of movement in three-dimensional space. While this provides an underlying structure for the interactive description of movement, it is not restrictive in the sense that an end-user of the system is offered a fixed set of terms to describe movement. An example of this is illustrated in Figure 56. Movement Attributes, where the terms body part, direction, and level open up the potential for diverse descriptions of movement to be created via the selection of associated menu items in the interface.

![Figure 56. Movement Attributes](image)
When broad terms that form a relationship relative to a description of movement are coupled with analogous images of its representation and corresponding Labanotation symbols, the combination of these elements functions to assist the understanding and subsequent use of Labanotation (see Figure 58. The Movement Editor, in the following section). In this way, a novice user of Labanotation may identify the shapes of Labanotation symbols and their positioning on a score more easily by visually comparing them in relation to the terms in which movement is described. This also extends to the associations made through corresponding image representations.

Figure 57. The Interface for LabanAssist illustrates the default setting of the interface design for the prototype application LabanAssist before a description of movement has been specified or documented on the score. It is important to understand that the provision of the system to assist the interpretation and practical application of Labanotation symbols is made possible once a description of movement has been specified through the selection of key terms. The visual association of imagery to the description of movement is in no way intended to present a connotation of a term to the end-user. If this were the case, however, the representation of such imagery would be suggestive of the meanings surrounding the use of a term. Imagery would then function to define the objects to which they were associated prior to their selection by projecting meaning in the interface. It should, therefore, be understood that the purpose of this research is not necessarily one of projecting meaning in the design of artefacts: rather, it is one of guiding the formation of ideas through interaction.

The delayed response of analogous images and Labanotation symbols with regard to the description of movement functions to provide a broad outline and representation of their description. In this way, the visual representations offered as a function of the system encourage interaction based on the creativity surrounding the composition of that movement. Contrary to the notion of providing a distinct or literal representation of the terms used to describe movement, artistic imagination is, therefore, not hampered or confused by the misrepresentation of movement between the function of the system and the user’s understanding. LabanAssist relies on the imagination of the end-user or artist to guide interactivity based on his or her own unique individuality of thought and action. This in turn enhances the experience of the user, and makes the exploration and generation of movement possible. The scope in which the selection of broad terms
Figure 57. The Interface for LabanAssist

presented in the design of an interface function to assist variety and choice will work to orient user thinking and, by this action, facilitate the production of poetic imagery as concrete symbolic representations.

Relationship to the User

There exists a potential for matter to transform and create new expressions of movement. It is envisaged that the way in which we primarily experience form through the active engagement and manipulation of changing and dynamic circumstances will facilitate the diverse formation of Labanotation scores. This is where change is the result of an artist or end-user’s capacity for interaction, and an understanding of their actions to develop in concert with the practises and knowledge of Labanotation.
This concept of change, however, is not considered in a mechanistic sense that looks to the physical combination and positioning of Labanotation symbols on a score. This is now a function of the system that a novice user of the system is not required to have a substantial knowledge of to achieve. While the visual representation and combination of movement as Labanotation symbols on a score does indeed change through the course of their composition; again, this is not the only type of changed relationship that is inferred. The changes previously described are the indirect material outcomes of interaction.

Considered in another way, the notion of change is centred upon one’s accomplishment to reach an objective or goal. This will drive the purpose behind the act of composing movement as Labanotation scores; especially where the actual creation of a Labanotation score is as a result of a new understanding that has developed in the practise of describing and documenting movement; but is not necessarily associated with its precise grammatical composition. The significance of change is therefore emphasised through the act of doing, which in turn enables an individual to cultivate an understanding of Labanotation. This is the result of new knowledge attained, whereby an initial inability to act is enhanced through participation, experience, and knowledge. For Plato (in Scully, 2003), the ability to become self-moving or to take action equates to a type of freedom. This is a freedom in which we are not subject to the forces or restrictions placed upon us by our surroundings or environment.

In the context of this research, these limitations are based on the utility of dance notation software systems and knowledge of movement notation systems such as Labanotation. While these elements encapsulate the boundaries in which members of the dance community can utilise them effectively, the ability to participate in the facility these technologies offer will necessarily occur as a result of interaction, practical experience, and learning over time. To assist this progression, LabanAssist is designed to facilitate a basic, elementary, intermediate, and advanced knowledge of Labanotation. Through the progressive development of each level of advancement, various forms of functionality are offered to end-users of the system to complement their skill and level of expertise. These levels are determined by a user’s preference before the application LabanAssist begins. It is, therefore, envisaged that the relationship developed between the user and the system of documenting movement that
LabanAssist provides is one that will encourage the sustained learning and use of Labanotation.

**The Movement Editor**

For novice users of LabanAssist, the Movement Editor is the unifying design artefact that makes interaction possible. It is fundamental to initiating the interactivity required to successfully describe and document movement. The functionality it provides extends to the subsequent use of the Score Editor and the Motion Viewer described below. The structure of the Movement Editor works to organise and arrange user interactions, and facilitates the natural development of movement which is to be described based on the task analysis structures created in the Task Analysis Workshop.

![Movement Editor](image)

**Figure 58. The Movement Editor**

Tidwell (2006) refers to the interface pattern “illustrated choices” as a way to enhance user selection and choice through the visual aid of imagery. This imagery can either be a substitute or in addition to the use of words. Because of this, the pattern provides a foundation for the design of the Movement Editor (see Figure 58. The Movement Editor), and supports the necessary interaction required to visualise movement. The combination of broad terms which represent movement attributes, human figure
illustrations, and Labanotation symbols in this interface artefact were designed to illustrate possible combinations of movement descriptions and their associated options through the selection of icons, buttons, and menu items. This pattern works to communicate the visual differences and similarities between various kinds of Labanotation symbols by offering a broad translation of their ability to illustrate movement positions and comparable Labanotation symbols. Again, this illustrated view is offered to end-users following their selection of a menu item. In this way, the illustrations work to underpin the symbolic description of movement and its grammatical context in a way that will not overtly distract or be detrimental to the creative formulation of its description.

The Movement Editor offers an alternative approach to supplying users of notation applications with a diverse range of symbol libraries. From multiple library pallets, users are required to access, search, identify, select, and position individual Laban symbols on a score. The Editor, however, works to assist those with little knowledge of the symbolic language to document the movement they wish to preserve. Labanotation symbols can be added to the score through the use of the Movement Editor in two ways. This is done through the selection of a single movement description, and/or the consecutive selection of a number of movements relevant to a particular beat and measure. By specifying a basic description of movement in broad terms via the selection of menu items and options, movement descriptions can be successfully documented as Laban scores. This can be completed without the complex task of manipulating and manually arranging individual symbols on a score.

When a fundamental description of movement has been selected, the Movement Editor indicates the possibility for its addition or placement on the score. This is achieved by highlighting the “apply” button located in the Movement Editor’s interface, which indicates to the user that the movement description can be added to the score. When the “apply” button is clicked, the Laban symbols that correspond to the movement selections in the Movement Editor are positioned on the score. Through the design of an interface that makes use of terms, symbols, and images to visualise specific elements of Labanotation, it is envisaged that the ambiguity surrounding the identification and interpretation of its symbols may be significantly reduced. Novice users of Labanotation will also benefit from the visual association the interface offers to gain an understanding
of their actions. This is where the visual associations made as a result of the active participation between system and user work to guide the intellectual understanding of Labanotation. Only through the selection of terms and interaction with the Movement Editor is this made possible. This in turn counteracts the potential for the passive conveyance of dance knowledge.

The Score Editor

As a complement to the Movement Editor, the Score Editor facilitates the correct syntactical and grammatical documentation of Labanotation symbols, and visualises their formation as Labanotation scores. The Score Editor therefore shapes the information of movement as described by an artist or end-user in the Movement Editor as a coherent form. This serves not only as a means to represent movement, but also as a cultural record that may be preserved and used by subsequent members of the dance community long after its initial documentation. The Score Editor serves a number of purposes in and of itself. It also shares significant relationships with other key interface artefacts contained in LabanAssist.

The visualisation of form the Score Editor provides is expressed in a number of ways. One is as an animated representation of movement. This is presented through the functionality of the Motion Viewer, as discussed below. Another is through a theoretical understanding of individual Labanotation symbols, which stand in isolation from one another while they stand in context with the larger whole. The very rationale of this singular function is to understand the purpose of each movement as it is expressed in part. However, the function of the Score Editor is also to develop an integrated understanding of movement from part-to-part or from one symbol to another; and an understanding of these parts in relation to a complete interpretation of the movement communicated. This is made possible via the selection of a symbol on the score, and is represented in various sections of the Symbol Inspector, also discussed below.

The Score Editor also works to assist the interpretation of Labanotation symbols by visually marking each column of a Labanotation staff (see Figure 59. The Score Editor, Labanotation staff). This is done in order to clarify the differences between similarly shaped symbols that may be confused because of a failure by the user to recognise their
Figure 59. The Score Editor, Labanotation staff

actual placement on the score. During the composition of movement, modifications to a staff’s setup can be made to facilitate the structural differences in complex or simple writing objectives. Visual guides along the left-hand side of the Score Editor can also be exchanged for one another to represent the manner in which a user prefers to mark the counts, beats, or measures of movement in a score to represent the element of time (see Figure 60. The Score Editor, dancers counts). Various grids positioned as a background to the symbols represented on the staff work to improve the visual clarity required to characterise the length and detailed positioning of complex movements on a score. Finally, a flexible playback head enables the forward and reverse viewing of movement to be represented in the Motion Viewer. It acts as a visual marker to indicate the specific beat, measure, symbol, or range of symbols being interpreted. In doing so, it seeks to establish a relationship between the movements each symbol represents (see Figure 62. The Motion Viewer, drag bar, in the following section).
The Motion Viewer

The function of the Motion Viewer is to translate Labanotation symbols positioned on the score by engaging the Score Editor to assist with a 3D representation of computer-generated animation. While LabanAssist is a prototype application, this functionality appears as a 2D representation of animated movement. This form of representation offers a means by which users may visually confirm or detect errors in the movement that they wish to preserve as a Labanotation score. This is achieved by utilising the playback buttons at the base of the Motion Viewer (see Figure 61. The Motion Viewer, playback) or by manually moving the red playback head up or down along the Score Editor (see Figure 62. The Motion Viewer, drag bar).

In this way, the translation and visual comparison of Labanotation symbols to animated movement, and vice versa, may assist novice users of the language to form a conceptual and visual understanding of the information contained within the Labanotation symbols. To assist in this visual comparison, the Motion Viewer itself may be repositioned in the
Figure 61. The Motion Viewer, playback

Figure 62. The Motion Viewer, drag bar

interface. This will enable a better alignment with the area of the score that is under consideration. End-users of the system are offered three additional, alternate views of the same movement in conjunction with the main view of the proposed 3D human figure animation. Based on individual preferences and selection, they allow for the representation of various visual perspectives in which the information within a
Labanotation score can be viewed. This will enable the user to gain a better understanding of complex movement. In addition, a floor plan is made available which provides an overview of the movement performed.

However, this interface artefact is not entirely new. Similar use of this form of technology exists within the applications LabanDancer (Tom Calvert, Ilene Fox, Rhonda Ryman, and Lars Wilke, 2005), LabanEditor (Hachimura, Matsuoka, and Yoshida, 2002), and DanceForms (Credo Interactive Inc, 2005a). The facility of LabanAssist differs from the above-mentioned applications because it offers the interpretation and amendment of Labanotation scores in the immediate documentation of movement. It achieves this as it supports a comprehensive range of functionality within a single prototype application, and functions more as a diagnostic tool. This allows novice users of Labanotation to evaluate their notation, and to interpret faults in their scores that are not grammatical in nature with greater ease. In this way, end-users of LabanAssist may immediately recognise and amend conceptual mistakes between their intent to describe particular movement and the notation documented in the Score Editor. Furthermore, in the documentation and revision of Labanotation scores, such practises may assist and encourage methods of self-assessment. This has the potential to further an understanding of the practicalities surrounding the creation, documentation, and interpretation of Labanotation scores. It is envisaged that the combined functionality offered in both the Score Editor and the Motion Viewer will make possible greater accessibility of the information contained within Labanotation scores to a wide variety of members across the dance community.

The Symbol Inspector

Similarities in the visual representation of a variety of Labanotation symbols can become increasingly difficult for novice users of the language to recognise and interpret. The misunderstanding and subsequent misuse of similarly shaped symbols can produce vastly different results in their identification, interpretation, and physical performance. To alleviate this, the Symbol Inspector is designed to elucidate an understanding of Labanotation symbols positioned on the score. It supplies users of the artefact with movement-specific details that are visually represented in a Labanotation score.
The Symbol Inspector works as a means to further identify the attributes of a selected symbol within the Score Editor. This can either be in isolation, apart from the potentially vast number of integrated Labanotation symbols positioned on a score, or in relation to the surrounding symbols on a score. The symbol tab within the Symbol Inspector (see Figure 63. The Symbol Inspector, symbol recognition) provides a description of a symbol’s attributes upon its selection. The functionality in this tab provides users with the ability to edit a symbol’s properties or simply delete it through the available icons beneath the resources heading. The Labanotation Library link opens an interactive reference library of information regarding the technical use of the selected symbol (see Figure 64. The Labanotation Reference Library). Incorporated within this information are links to LabanLab’s online interactive Labanotation tutorials (Marion, 2001).

The measure tab, found within the Symbol Inspector, works in conjunction with the symbol tab and supplies a contextual understanding of a selected symbol in relation to other Labanotation symbols surrounding it on the score. It does so by indicating movement that is defined, undefined, continuous, or previously specified in relation to the beat and measure of the selected symbol (see Figure 65. The Symbol Inspector, measure contextual recognition). This interface item aims to clarify instances where the lack of a symbol’s representation on a score may characterise movement from a previous frame or movement that is yet to be defined. It achieves this through the use of colour association between the Labanotation symbols, the parts of the human figure illustrated, and the circumstances surrounding each movement. The use of colour in this instance is also represented in the interface through varying degrees of lightness and darkness. This is done to facilitate the above associations, between different elements of movement and the symbols they represent, to be made by end-users of LabanAssist that may suffer from colour blindness. The idea of a symbol inspector or a property inspector can be found as an existing feature within most of the leading computer graphic, animation, or illustration programs. This also shares similarities to the functionality of a frame editor (Singh et al., 1983), which is used to illustrate the current status of a score in a graphics editor for Benesh.
Figure 63. The Symbol Inspector, symbol recognition

The Symbol Inspector’s symbol tab is displaying the attributes for the symbol that is highlighted in red on the score.

Figure 64. The Labanotation Reference Library

The Labanotation Reference Library is displaying technical information regarding the use of the symbol that is highlighted in red on the score.
Figure 65. The Symbol Inspector, measure contextual recognition

The Symbol Inspector’s measure tab is displaying the attributes for the first beat of the first measure that is highlighted in red on the score. The red symbol on the score indicates the original symbol selected to obtain this contextual information. The measure tab illustrates movement defined in beat one of the first measure; movement from the starting position that is relevant to the performance of beat one; and movement that has not been defined in the first beat of the first measure.

Summary

The complexities of describing movement were explored to better assist the characterisation of a broad set of terms that enable the generation and documentation of a wide variety of movement descriptions to be created. Information garnered as a result of the poetics of the initial design requirements assisted in the design of a hierarchical structure for the arrangement and ordering of movement to facilitate diversity in their selection and description. Participatory design techniques that involve potential users of the system in the design process supported the development of design rationale for this system of interaction. It is suggested that a combination of visual tools can be used to facilitate the visualisation of information that communicates knowledge of decision-making processes in collaborative working environments. In this way, participatory design techniques may be enhanced to enable a shared knowledge of design criteria to be made explicit for productive interaction and its evaluation.

A designer’s ability to grasp the major themes and concepts developed during participatory design workshops is central to the formation of design of products that effectively enhance the experience of others. This is apparent where the design of associations and relationships between the functional elements of an interactive product work to encourage and guide productive actionable outcomes. Beginning with a
principle for design that supports the development of an open system for interaction, the
interface artefacts within LabanAssist each contribute to a flexible and dynamic
description of movement. These artefacts provide a variety of means in which
movement can be described, documented, and understood. They work together to meet
an objective shared by members of the dance community. This process is facilitated by
the system of interaction offered by LabanAssist. It draws on the concept of tropes that
enable individual interpretations and meanings to take shape. This suggests that
interaction and interface artefacts can be appropriately designed to structure complex
information, and allow for diverse use situations through a play of tropes represented as
broad associations of terms in the design of an interface.

However, the intention behind the design of an operational structure to support the
correct syntax and grammatical composition of Labanotation scores must be evaluated.
This necessarily involves potential end-users of the system to fully understand the value
and function LabanAssist provides in the practical documentation of movement as
Labanotation scores, and its ability to communicate its utility. I turn my attention to the
evaluation of LabanAssist in the following chapter.