EVALUATION OF MUSIC NOTATION PACKAGES FOR AN ACADEMIC CONTEXT

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PREFACE

This notation evaluation project, based in the Music Department of the University of Glasgow, has been funded by JISC (Joint Information Systems Committee), JTAP (JISC Technology Applications Programme) and UCISA (Universities and Colleges Information Systems Association).

The result of this project is a software evaluation of music notation packages that will be of benefit to the Higher Education community and to all users of music software packages, and will aid in the decision making process when matching the correct package with the correct user. Six main packages are evaluated in-depth, and various others are identified and presented for consideration.

The project began in November 1999 and has been running on a part-time basis for 10 months, led by Pauline Donachy under the joint co-ordination of Carola Boehm and Stephen Brandon.

We hope this evaluation will be of help for other institutions and hope to be able to update this from time to time. In this aspect we would be thankful if any corrections or information regarding notation packages, which readers might have though relevant to be added or changed in this report, could be sent to the authors.

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INTRODUCTION

Music notation is integral not only to dedicated HE courses and academic institutions, where creation, communication and dissemination, teaching and learning, research and development, installation, integration and administration, are of crucial importance, but it is also relevant to anyone working with music in areas such as: the performing arts, sound engineering, music libraries, multimedia, music research and analysis. Whenever music has to be displayed or played, notation packages are required. Most institutions, are not aware of existing packages catering to their specific needs, and either spend too much on professional packages – which are then due to their complexity often under-used, or they use basic packages which do not have professional output or cannot be adapted for their needs. The acquisition of a specific package has a great impact on the whole life of the department, and selection of the correct music notation package is often more than simply *One person-One computer-One software package-One professional looking score*. It is also for these reasons that we chose to opt for a dual evaluation method: looking at both general and academic music-specific criteria.

For readers wanting to not wade through the whole evaluation, but rather having to make a choice relatively fast, it is advised to read first the conclusion, which groups the packages according to different user communities. After reading this, one may go back and read in more detail the evaluation of the specific packages.

We have also found that that the evaluation helps in first steps in using the main packages, as it points out the most glaring faults and bugs, which may leave a beginner helpless.

We hope this evaluation will be of help for other institutions and hope to be able to update this from time to time. In this aspect we would be thankful if any corrections or information regarding notation packages, which readers might have though relevant to be added or changed in this report, could be sent to the authors.

TYPES OF PACKAGES AVAILABLE AT PRESENT

There is an enormous and diverse range of music notation packages available at present. These packages are so varied because the ethos behind the various packages is equally wide ranging.

Some packages operate from an engraver or publisher's point of view. Their aim is to produce professional scores of publishable quality. As such they are page-oriented in design, and the layout, formatting and operation of the package reflects this. Within this type of ethos, there are also various approaches. Some packages mimic text typesetters and operate on a DOS system similar to book publishing, whereas others aim to be more user-friendly and operate on a more WYSIWYG design.

Other packages seem to operate from a more composer-oriented stance. They are more intuitive and are organised to aid the composer in various aspects of creation, playback and production of the music. This type of package is generally more user-friendly and approachable for all types of user. However these also vary radically in terms of complexity and features offered.

Yet other packages try to capture the whole market, and have approachable and intuitive features, whilst retaining the page-oriented design and offering publishing terms and facilities. All of the packages naturally differ in terms of the breadth of features offered and how they can be manipulated. As such, they appeal to different users for different reasons, thus trying to match the correct user with the ideal package can be difficult: in this evaluation we hope to make this decision making process easier.

NEEDS WHICH THESE PACKAGES SUPPORT FOR AN ACADEMIC COMMUNITY

There are a variety of requirements that need to be supported by notation packages being used in academic and multi-user communities. The following give an indication of the main areas of importance:

Creation – of music and music examples to accompany text by professionals, teachers and students.
Composition – learning techniques and producing professional results.
Dissemination – of music to as wide an audience as possible: professional, students, research.
Performance – of the music through good standards of scores, and through computer-aided techniques.
Teaching music – in various academic and non-academic environments.
Learning about music – through tutors and computer-aided techniques.
Research and Development – within the music community as a whole.
Installation / Administration / Integration – of the package easily, efficiently and effectively into a new or pre-existing environment.
Other capabilities – such as support for new technologies such as scanning and the Internet.

OUR EVALUATION IN RELATION TO THIS

Initially, we investigated a range of systems for assessing music notation packages by looking at various types of evaluation methods such as: Nivergelts, Nielsen, Apple Mac, Golden Rules, Semantic and Conceptual models, and HCI. Although these can be very successful concerning general aspects of system acceptability, we felt that as they were not designed to truly encompass music notation packages. We found them to be lacking in important, unique, music-specific criteria as they did not fully support the needs of a music community – indicated above.

This led us to create our own set of HE / Academic / Multi-user specific criteria in relation the needs of this music-specific community – based on exactly those needs outlined in the above section. Therefore, the first part of the evaluation comprises of five sections, with their own individual criteria:

Creation, Communication and Dissemination
Teaching and Learning
Research and Development
Installation, Integration and Administration
Other Capabilities, such as web support

In addition to this, we felt that there was a need to include more general / traditional criteria in order to encompass the interests of the full range of users, and also to give a stronger representation of the package as a whole. We based this section on Nielsen's Model of System Acceptability (1993b), and also encompassed various aspects from other models which we looked at. We have expanded this outline with criteria that we feel matches the needs of an academic / multi-user community, as can be seen more fully in Section Two. In doing so, we believe that our evaluation will be of use to as wide a variety of users of music notation packages as possible.

OUTLINE OF THE EVALUATION

The following is an outline of our evaluation methodology:

```
Evaluation
of Music
Notation
Packages
        ├── Specific Higher
        │   Education / Multi-
        │   user Criteria
        │       ├── Creation, Communication and Dissemination
        │       ├── Teaching and Learning
        │       ├── Research and Development
        │       ├── Installation, Integration and Administration
        │       └── Other Capabilities
        │
        └── General /
            Traditional Criteria
                ├── Social
                │   Acceptability
                │       ├── Suitability for Specific User Groups
                │       └── Advantages / Disadvantages over the
                │           'norm' for a Package of this Type
                │
                └── Practical
                    Acceptability
                        ├── Usefulness ── Utility
                        │              └── Usability ── Learnability
                        │                            ├── Efficiency
                        │                            ├── Memorability
                        │                            ├── Computer Feedback /
                        │                            │   Error-Handling
                        │                            └── Subjective Satisfaction
                        ├── Cost
                        ├── Compatibility
                        └── Reliability
```

The subsequent section, Section One, will give a fuller account of the reasoning and methodology behind the evaluation of the six main packages, and Section Two will display the results of each package according to these criteria.

SECTION ONE

This section hopes to give an explanation as to the criteria we have chosen and why. In order to realise the evaluation properly it is necessary to explain and highlight the reasoning behind our choice of criteria, and it is also necessary to give an idea of the type of things we were looking for in relation to these criteria.

Therefore, the following sections introduce the reasoning behind our choice of criteria, and indicate the main reasons why importance was given to them: what advantages they, in particular, hold for an academic / HE / multi-user community.

There is also a set of reference tables at the end of this section that follow the way in which we have analysed each of the six main notation packages. The right-hand column in each of these tables in this section shows what we were looking for in relation to each of the criterion (whereas it gives the results in Section Three), while the left duplicates the criteria used in the evaluation proper. This means that cross-references between the reasoning and the results can be achieved easily and effectively.

1.1   GENERAL / TRADITIONAL CRITERIA

In general contexts, traditional evaluation criteria like the Nielsen Model (1993b) can help to evaluate system acceptability. This model is based on Social Acceptability and Practical Acceptability and their various components, as shown in the diagram below.
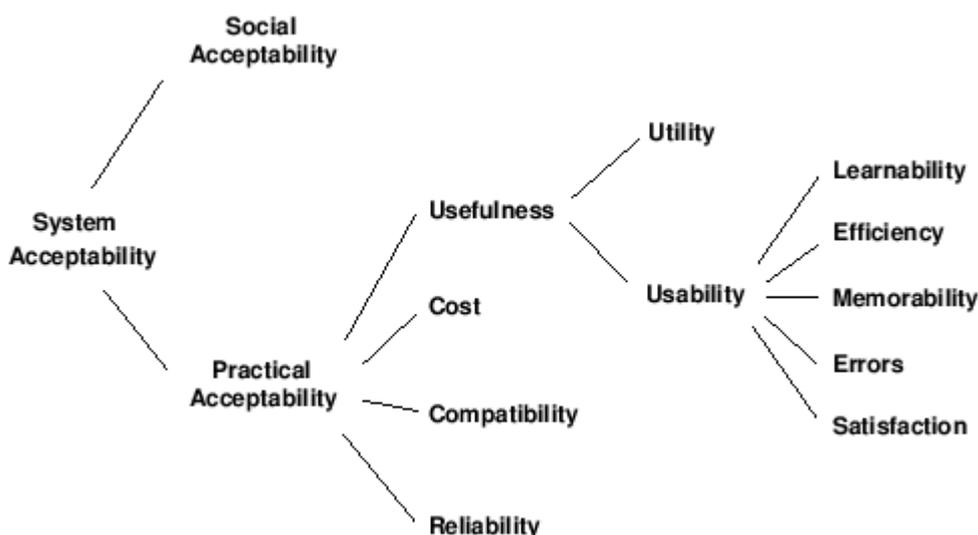
We do not feel, however, that this model is fully comprehensive in relation to music-specific attributes, and therefore the full layout of our evaluation is loosely based on this model, but also takes into account various other models, such as: Apple Mac, Golden Rules, HCI, Nivergelts semantic models and conceptual models. Using these as an outline we have given our interpretation of music-specific criteria which help to clarify these ideas, and which, in some cases – especially with Social Acceptability, expand on the basic outline with music notation packages in mind.

The introduction to each package is intended to highlight the intent of the package. This will give general idea concerning the 'mission statement', so to speak, of the manufacturers, and will also give a basic introduction to the package and the main areas that are of interest on initial approach – giving the user an initial idea of the purpose of the package.

1.1.1 Social Acceptability
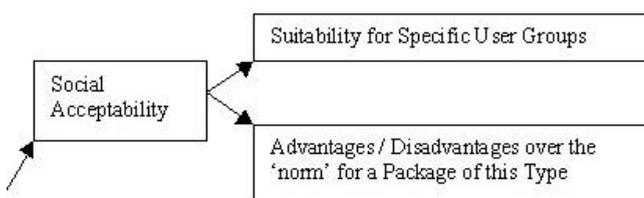
Identifying the **Suitability for Specific User Groups** mentioned also helps to focus on who the package is aimed at, and those for whom it may not be as suitable for.

Advantages and Disadvantages help to identify unique features of specific packages that may make the package very attractive, or, perhaps, totally unsuitable.

1.1.2 Practical Acceptability: Usefulness
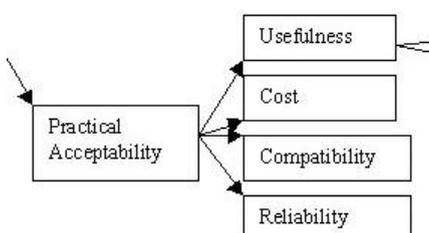
In addition to Social Acceptability, Practical Acceptability is split into four main components: Usefulness, Cost, Compatibility and Reliability. Usefulness is further split into utility and usability. Utility can be said to be the more practical aspect of the package – the "paper" specifications, whereas usability can be said to be the package "in practice" – a subjective account of how the system operates.

Utility
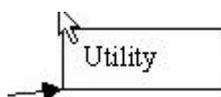
Our criteria for the Utility aspect of Usefulness can be seen to be integrated with the criteria for specific HE and Multi-user environments below: the Utility of the package depends on its use, and therefore in HE and Multi-user specific contexts, utility is centralised around the functions that the package offers in relation to this.

Usability
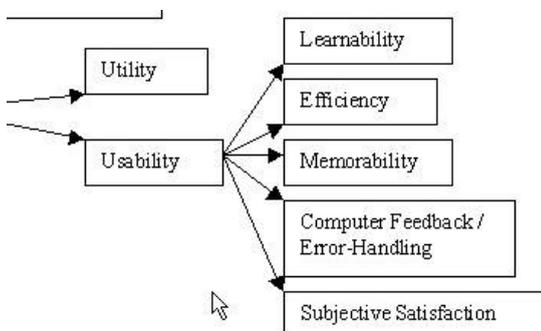
It is useful to highlight the **Learnability** of a package because initial contact and introduction to a package greatly affects whether the user understands and feels comfortable with it. If it is difficult to come to terms with initially / has a steeper learning curve, or if there are non-logical results to an action, then certain users may be intimidated by the package and, naturally, be put off from using it. If this can be highlighted, then the user can weigh up the full pros and cons of learning and using the package.

Efficiency – the support of the package through tools which allow easy and, or, rapid achievement of aims – enhances the usability and general usefulness of the package. If there is no allowance for shortcuts or macros within the package, or equally if there is an excess of dialog boxes / mouse clicks to go through before a task can be completed, then input and manipulation can become a long, drawn-out and disagreeable process.

Memorability is directly linked to the efficiency and learnability of a package. In order for a package to operate well it is central that there is clear, logical and consistent placement, order, layout and operation of features. This enhances the confidence of users both in the package and in their own capabilities.

Computer Feedback / Error Handling also affects the users' perception of the package. Good interaction and communication between the user and the programme inspires confidence, and affords the user insight into whether or not actions are happening, and why the package operates in such a manner. This offers the user an understanding of how the package operates and enhances user knowledge, resulting in its better use.

Subjective Satisfaction is, by nature, only found in the eyes of the individual, and as such it is necessary to give as wide a range of opinions, from as wide a variety of users, on the package as possible. Appendix 1, therefore, presents additional opinions and views on packages as communicated through the various workshops and questionnaires disseminated in the course of the evaluation.

1.1.3 Practical Acceptability: Other Criteria
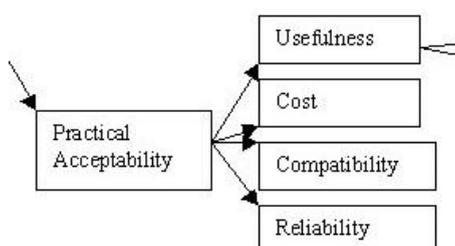
The above are concerned with the Usefulness criteria of Practical Acceptability, the following deal with other criteria - Cost, Compatibility and Reliability. These criteria could be said to be particularly relevant in a HE / Multi-user environment where bulk buying and discounts come into play, however, they are also important in a more general sense.

We have given a general **Cost** indication for each platform, including discounted pricing for educational, bulk-buying, upgrades and multi-user licenses where possible.

Compatibility is especially important for multi-user installations. By indicating the platforms that the package operates across, and by highlighting file formats that allow interaction between different packages – music and text, the full range of compatibility and flexibility of the package is shown.

Reliability is also an important feature of the package. Minimum crashing and maximum – and continuing – user support provided, gives the user confidence in the quality and reliability of the package.

The second part of our evaluation concentrates on very specific needs of higher education and multi-user communities as indicated in the Introduction. The reasoning for our criteria in this section of the evaluation, and why these criteria in particular are important, can be seen below.

1.2 HIGHER EDUCATION / MULTI-USER SPECIFIC CRITERIA
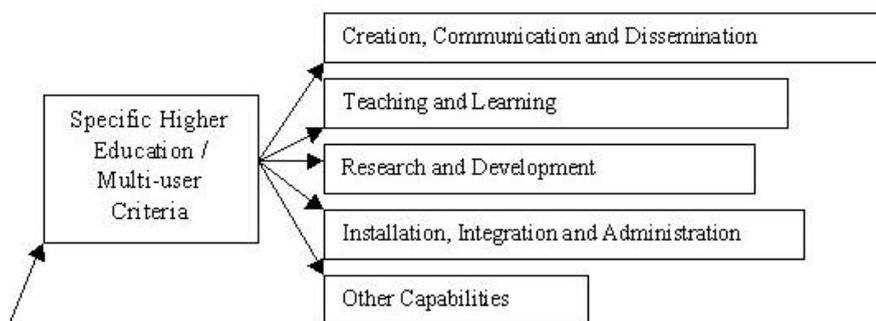
It should be noted, as mentioned in the Introduction, that the criteria for the following HE / Multi-user specific area contains aspects that we feel are important to consider in relation to a music notation package suitable for specific academic requirements. This section is not based on any other models or existing methods of evaluation.

Creation, Communication and Dissemination are integral aspects of music in an academic context, and as such, we feel that the practical support given by each of the packages, in terms of input, output and handling / manipulation of these areas, should be highlighted as they are the basic functions that a user normally requires.

The **Teaching and Learning** section gives an opportunity to highlight those features in each package that can be specified directly as being of advantage in a teaching or learning environment. These advantages can be on screen / visual attributes, audio, help, tutorial, or platform based.

Research and Development is important, and often neglected, where music notation packages are concerned. The ability to expand and fine-tune packages to individual needs – through programming languages, developers' kits, shortcuts and any other methods of tailoring the package or expanding its capabilities – is central in an academic context as there can be highly specific uses and functions that a package needs to perform in such an environment.

Installation, Integration and Administration is fundamental to any area in which a package is networked, included in an existing set-up, or where there is more than one package at a time being used. The ability to install, update, integrate and administer the package easily and efficiently within a pre-existing or new networked environment helps to maintain good working practices and reduces the strain on a department that may have ten, twenty, or more computers, with a corresponding number of packages to service.

Other Capabilities – the support for Internet publishing and compatibility with standard graphic and music formats readable by browsers is increasingly important in an electronic publishing context.

A **Summary** of the package is given at the end of each evaluation as a quick reference guide, outlining some of the areas discussed above, and giving a general idea of the package.

Until now there has been no formal expression of the above needs in evaluation terms. They are especially important in HE / Multi-user environments where these packages are used professionally, day in, day out.

Our intent throughout this evaluation is to assess various aspects of each package with reference to specific features of importance in a HE / Multi-user environment and with regard to more general system acceptability requirements as detailed above. This approach enables the evaluation to be useful to a wide range of users, whilst remaining valuable for the academic music community: allowing the match of the correct package with the correct user.

1.3   REFERENCE TABLES

The following is a compilation of tables that indicate the precise criteria that we are looking for in the above areas concerning each of the six main packages. These packages were chosen according to their popularity, long-standing and prevalence of use in music and higher education environments.

1.3.1 Table of Social Acceptability Criteria

Social Acceptability	Looking for…
Suitability for Specific User Groups ᴜ Specific languages ᴜ Disabled ᴜ Music specialists ᴜ Novices to the package	**Whether the package caters for all users, or only specific types of users?** *Availability of other language versions of the package, or whether it is purely English-oriented. Alternative fonts and character encodings.* *Any specific features that would be of benefit to a disabled user.* *Whether the package caters for all types of music specialists: performers, medievalists, composers, and publishers.* *Whether the package is accessible to all users, or whether there are any obstacles for novice users.*
Advantages / Disadvantages over the 'norm' for a Package of this Type ᴜ Does the package have any special advantage over others of its kind ᴜ Does the package have any disadvantage over others of its kind	**The main advantages and disadvantages of this package.** *Features or facilities offered that are unique or especially notable.* *Features or facilities that pejoratively affect perception of the package.* *An indication will be given concerning whether or not these are intrinsic to the platform.*

1.3.2 Table of Practical Acceptability – Usefulness

Practical Acceptability Usefulness: Usability	Looking for…
Learnability ப How easy / straightforward is it to learn initially ப Direct manipulation / User control vs. computer control ப Numerical values ப WYSIWYG ப Obvious directives and results visible ப Aesthetic integrity, consistency and reliability – within and between the packages	**Whether the package is easy or hard to learn initially.** *Introduction to the package through the manual, tutorials, summary cards, organisation and placement of menus, error messages, pre-requisites needed for understanding and accessing the package, and problems encountered initially.* *How specific and global adjustments are made: manually, by menu, by mouse, by inspector, by shortcut. Hindrances to direct manipulation such as 'handles' or a high volume of forced actions.* *Which items can be entered or manipulated numerically, and alternative types of manipulation.* *Whether, and how, the package is WYSIWYG oriented.* *Direct / immediate correlation between manipulations by mouse, menu etc., and the on-screen result.* *Standard shortcuts and platform conventions. Placement and ease of access to these. General menu and dialog box organisation. Whether all attributes of an object readily available.*
Efficiency ப Ease of use: are there extraneous / unnecessary / confusing aspects ப Are shortcuts and macros available ப Excess number of mouse clicks needed ப Templates ப Functions which should be automated	**How efficiently the package operates.** *Attributes or features that could be seen to obstruct, constrain or confuse the aims of the user.* *Type of shortcuts available, and whether use of macros is encouraged or not.* *Whether the user has to click excessively or make a cumbersome number of selections to get a result.* *Type and quality of templates.* *Actions and manipulations that are not easily achieved.*
Memorability ப Aesthetic integrity, consistency and reliability – within and between the platforms ப Knowledge in the Head and Knowledge in the World	**How straightforward the package is to remember.** *Standard functions and shortcuts, how operations are accessed, consistency of formatting and layout, the function of menus, the mouse, shortcuts, inspectors, toolbars. General features that aid or restrict memorability.* *Whether graphical symbols and objects make clear and obvious links with their intended function.*
Computer Feedback / Error-Handling ப How are errors dealt with ப Do they explain what is happening ப Do they explain why it is happening ப Is it always possible to exit / undo ப What is the error rate / Do warning messages interfere with or interrupt the flow of input? ப Does the package 'forgive'	**How the package generally copes with errors.** *What happens: whether errors are ignored (nothing happens), and whether there is feedback of any sort.* *Whether there is feedback given explaining what the computer has done / not done.* *Whether there is any reasoning given as to why this course of action / non-action has been taken.* *Whether there is an undo or exit function available.* *Whether the package has a high or low level of interaction with the user.* *As a result of the above, whether the package is 'forgiving' of the user.*
Subjective Satisfaction ப On first approach ப Overall ப Specific elements which affected experience ப Other user's experiences of the packages – which they use now, and why	**The likeability of the package.** *User-friendliness, manual, tutorials, help and organisation of the package.* *What the package is designed for, or not. The ability to tailor the package and produce a professional result. Thoughts on general accessibility.* *Positive and negative experiences that influenced the subjective satisfaction of the package.* *The results of questionnaires and workshops relating to other users' opinions on the packages, to be found in Appendix 1.*

1.3.3 Table of Other Practical Acceptability Criteria

Practical Acceptability	Looking for…
Cost	**Pricing structure for academic and non-academic buyers.** *General price per package for Mac and PC, options to upgrade / trade-up, academic discounts, multi-licence discounts.*
Compatibility ᴜ With other platforms ᴜ With other programmes	**General compatibility.** *On Mac and PC, with other packages – music and text-based.*
Reliability ᴜ Crashing ᴜ Suppliers help	**General reliability.** *Whether the package crashed, and if so when and how often.* *How good the manufacturers' help is, both internally and outwith the package: manual, help, email and approachability / responsiveness of the author / company.*

1.3.4 Table of HE / Multi-user Specific Criteria

HE / Multi-user Specific	Looking for…
Creation, Communication and Dissemination of music Ranges and Quality of Input / Output: ᴜ Playback ᴜ Visual ᴜ Keyboard ᴜ Midi / Sequencer ᴜ Other Input Methods ᴜ Score Scanning / OMCR ᴜ All types of music – 'traditional' to 'modern' ᴜ Handling of large scores. ᴜ Support for collaboration / transfer between other programmes: music and text ᴜ Professional result for publications (analytical, research and other)	**Ease, variety and quality of creation, communication and dissemination of music.** *Good quality playback and the ability to transpose, solo, and mute in addition to the inclusion of playback enhancements such as MIDI awareness, humanisation, swing, reverb and spacialisation. The overall perceived sound quality and how playback reflects features in the score.* *On-screen attributes such as: the zoom / magnification feature; true WYSIWYG; equidistance of he lines on the staves; when accurate input is possible; fonts available; default settings; redrawing and switching views; whether the screen changes to fit views; and graphical remnants.* *Type, ease and quality of keyboard input, and accuracy of results.* *The ability to import, export and playback MIDI files.* *Other input methods available apart from mouse input and those mentioned above.* *Option to scan-in scores / for Optical Music Character Recognition. Package used for scanning and evaluation of it if in-built into / included with the package.* *Types of notations that the package is designed to cater for and ease of input: related to the input of four musical examples ('traditional', 'avant-garde', guitar and lute) – see Appendix 1.* *How the package copes with insertions, deletions, part extraction, pagination changes and reformatting in a large score – 15 pages or more.* *Which formats the package saves, copies, opens, imports and exports.* *Overall quality of the package with regards to professional publication: a summary of the above.*
Teaching and Learning Presenting and manipulating in a multi-user learning environment: ᴜ On screen ᴜ Audio ᴜ Tutorials ᴜ Help ᴜ Specific platform advantages for packages that aid teaching	**Features that are particularly relevant or helpful for a teaching and learning environment.** *Particularly good display or magnification features, easy copy and paste between paste between packages and useful plug-in features.* *The ability to synchronise audio and page turning, for example.* *Quality, location, accessibility and ease-of-use of tutorials. Interactive / video tutorials etc.* *Quality, accessibility and ease of use concerning package help facilities. Support for bubble help, context-sensitive help and music-specific technical help: checking harmony, keyboard fingerings.* *Specific platform advantages that may be of use in a teaching and learning context,*

	such as Screencast, easy copy and paste.	
Research and Development Support for: u Extension and Expansion u Fine Tuning u Collaboration and general standards	**The support given for tailoring or extending the capabilities of the package to individual requirements.** ***Modularity***, *plugability, the availability of a software developers' kit and programming capabilities.* ***Options*** *for shortcuts and editing plug-ins: General, Music-specific, and Self-created.* ***Support***, *downloading and playback of other technologies / other standards and formats.*	
Installation, Integration and Administration u Ease of installation in network / multi-user and single workplace environments and ease of administration.	*Options for multi-user installation, network installation, user profile management, etc* *Options for easy installation for network administrators, support for multi-platform, multi pc networks* *applications do not change system files, clashes between hardware and software configurations* *expansion possibilities, software development, etc*	
Other Capabilities	***Options*** *to create web files / web pages, and to save, copy, import, export or open graphic formats – GIFF, TIFF, JPEG – and music formats such as SMDL, NIFF, DARMS.*	

SECTION TWO

The following section gives the results of our evaluation of the six main packages in accordance to the specifications given above. The packages are arranged alphabetically, and all details are accurate as far as we know at this point in time.

2.1   CALLIOPE RELEASE 4040 FOR OPENSTEP ON PC

2.1.1 Traditional-Criteria Results for System Acceptability

Calliope is 'organised with the assumption that you have a clear idea of what you are going to be doing with the notation (…) that you are working from some pre-existing notation (…) and have a page design in mind.' (Tutorial: Lesson 1) On saying this, it is important to note that it is not imperative to know what your document will look like, it simply helps.

Calliope works from a page-oriented and publication viewpoint, and as such, objects on the page are independent from one another. For example: notes can be positioned anywhere, with or without barlines being present; each stave and system is independent from the others – there is no run-on between staves unless specified; and the formatting of the page is not carried out until specified manually ('Adjust to width / design'). These operations are not invoked until the musical intelligence of the package is induced. In relation to this, the package operates from the viewpoint that the user knows what they are doing – there are few 'illegal' actions, and the package does not give automatic feedback on whether the instruction has been carried out or not. Calliope always assumes that the request has been carried out. The above allow flexibility when inputting into a score, but can be quite intimidating and confusing for a novice user.

Calliope is not explicitly designed to cater for avant-garde notations requiring partially hidden staves, or for guitar notations, however it does offer graphics and lines / square / rectangular shapes to be used, and caters for complicated tuplets. These types of notations can be achieved to a good level by manipulation of the features available.

Social Acceptability	Calliope
Suitability for Specific User Groups ⊔ Specific languages ⊔ Disabled ⊔ Music specialists ⊔ Novices to the package	*The package is English-oriented, but does offer standard NeXTStep character encodings and symbols for French, German and other languages. It does not offer any non-English versions.* *The package is largely mouse-based and there is not much support for keyboard or other input. There is a facility for on-screen colours for the display only, and the zoom / magnification facility is quite large: however there are no plug-ins or special advantages for a disabled user.* *Calliope caters extremely well for medieval music specialists, but not explicitly for those wanting to develop the package through plug-ins or programming – although the creator has been very helpful to music departments in these respects. It also does not really cater for guitar or avant-garde composers, although the existing facilities can be manipulated to produce good results.* *Although the tutorials are good, the package can be quite intimidating to novice users and is not the ideal package to compose straight into as it caters more for the visual rather than creative aspects of notation. Also, the poor help facility adds to this lack of accessibility. It caters for a more moderate-to-high learning curve, where musical knowledge would be helpful, but is not imperative.*
Advantages / Disadvantages over the 'norm' for a Package of this Type ⊔ Does the package have any special advantage over others of it s kind ⊔ Does the package have	*Advantages: It is especially good in catering for older / medieval notations. The publishing-specific terms – rastral numbers, picas and points – would, I imagine, help when creating professional publications. The ease of access to, and use of, the inspector feature* is particularly helpful. The ability to print 2- and 4-up* is a useful feature, as is the easy copy and paste of partial areas to text processors*. The ability to alter default settings for tools by selecting either 'Tool' or 'Set' from the inspector menus allows customisation and aids easy and fluid workflow.* *Disadvantages: The most prominent disadvantage is the lack of an 'undo' feature – which*

any disadvantage over others of its kind	*can be extremely frustrating. The toolbar is not particularly flexible as it can only be manipulated horizontally and vertically: it cannot be resized, or altered to fit onto the screen better, and the screen can get cluttered. There are problems with the MIDI file input, wherein incorrect voicings can cause problems with formatting. There are also complications with the playback feature, which is quite temperamental and has a tendency to crash. The need for a correct assignment of parts before part extraction is possible is also disadvantageous, as is the poor help feature and lack of user-support within the package.* * This is platform specific.

Practical Acceptability Usability: Usefulness	**Calliope**
Learnability ⊔ How easy / straightforward is it to learn initially ⊔ Direct manipulation / User control vs. computer control ⊔ Numerical values ⊔ WYSIWYG ⊔ Obvious directives and results visible ⊔ Aesthetic integrity, consistency and reliability – within and between the packages	***The** tutorials are very helpful, however there is no manual, or on-screen help to link-up with this to support the user. This means that if you have a problem, the only way to solve it is to go through all of the tutorials again, unless you can remember which specific one deals with that area. This also suggests that there is no margin for mistakes, and that it is not really possible to try things out: any errors have to be deleted and restarted. Having an idea of how your page should look is helpful, but not necessary. Also, operating from the publication and page-oriented view, the fact that objects (staves, systems, bars) are independent of one another can be problematic at first, as manual adjustments and manipulations need to be mastered.* ***Direct** manipulation is achieved mainly through use of the mouse. Manual adjustments override the automatic features, and these can be achieved through the inspectors and drop-down menus. There is a lot of flexibility in the package, but if an action is done which does not make sense to the musical intelligence of the package, then the programme ignores it. For example, if graphical symbols are used within the score and 'Adjust to width or design' is selected then the formatting is mis-aligned as this calculation does not take account of graphics.* ***Numerical** values can be input for page formatting and the set-up of a document: the page and system layout; the paper size; margins; staff height (in rastral numbers, points or inches); instrumentation; and for tailoring the offset of staves. It is also possible to manipulate some of these using the mouse, but the input of numerical values is the main method used – especially concerning the format and layout. Standard alternatives are also given, such as A4 / rastral 8, which can be accessed by clicking on the appropriate radio button.* ***The** package is page-oriented, therefore, what you see on screen is printed out. There is a high trust relationship between the on-screen image – at high magnifications – and the printed output. Also, the changes made by clicking and dragging are immediately reflected on-screen when completed. The quality of WYSIWYG is extremely high due to the 'Display PostScript' system on NeXTStep.* ***Calliope** does not give the user a lot of messages concerning the success / completion / or not of an action – it assumes that the action has been carried out as directed: it does not tell you if this is not the case. Therefore, sometimes the result, or non-result, of an action is not obvious.* ***Inspectors** can always be found, if available, by double-clicking on an item. The package conforms to standard NeXTStep conventions relating to shortcuts. Other shortcuts are minimal, and if available concern CMD / CTRL-clicking and pressing a key for note values and rests. Some shortcuts are given on the main menus, but the majority are not – they are only available from the tutorials. The order and placement of items in the menus is quite logical, however there were certain elements that I thought were unusually placed. For example: 'Open MIDI' is to be found in the 'Developer' menu not in tools; the 'Help' facility is found in the 'Info' menu; as is the 'Application Preferences' menu – which encompasses 'Tiff export options' – which I found to be an unusual placement. Also, 'Perform' is used instead of playback in the 'Tools' menu, which is unusual terminology. These detract very slightly from the aesthetic integrity and consistency generally found within the package.*
Efficiency ⊔ Ease of use: are there extraneous / unnecessary / confusing aspects ⊔ Are shortcuts and macros available ⊔ Excess number of mouse clicks needed	***Lack** of an undo facility hinders efficiency. Restricted input by mouse can slow down the input and manipulation process – as can the lack of shortcuts / keyboard support. Beams / heads of notes sometimes flip for no apparent reason if you click on the note, and it can be difficult to fix stem direction when the notehead is dragged up / down. There is limited MIDI input. Also, the stave you want to work on must be highlighted in order to input into it, and treating staves independently can be problematic at first. The method for naming staves / parts is not obvious, and is not provided in the tutorials. At times, two systems are highlighted when only one is selected, meaning that operations to one happen to the other, and it is only possible to*

∪ ∪	Templates Functions which should be automated	*realise this if the system inspector is activated, or the whole screen is viewed. Dynamics are found under the punctuation tool. There is both an 'Info Preferences' and a 'Document Preferences' menu, which could be combined under an all-encompassing 'Preferences' menu, and header and footer features can be quite complicated.* ***General** / standard NeXTStep shortcuts and a few music-specific shortcuts are available.* ***Mouse** clicks are not excessive.* ***There** are no templates provided.* ***There** should be a separate menu for dynamics – they should not be hidden in the articulations menu. A change of key signature should alter the whole document automatically, without having to apply it to each system.*
	Memorability ∪ Aesthetic integrity, consistency and reliability – within and between platforms ∪ Knowledge in the Head and Knowledge in the World	***Standard** NeXTStep keyboard functions and shortcuts are available. Inspectors are normally accessed by double-clicking, or by selecting 'Inspector' in the 'Object' menu. The formatting is consistent within inspectors: boxes with icons to be highlighted for selection, drop down menus and 'tool' 'set' 'revert' and 'cancel'. Handles are used for attaching objects to staves / notes, however these are quite easily accessed and manipulated. Moving text boxes can sometimes be problematic as they can only be moved using the top-left corner – as can naming systems / part assignment and using headers and footers. Menus are used for global commands; Inspectors cater for specific selections or to reset something as a tool; the Toolbar is used to insert and change items; and the mouse is used to select / change the properties of, and move, items on screen. This is consistent within the package and helps memorability.* ***The** paste tool – represented by the mouse – although linked to the fact that paste can be achieved by clicking the mouse, does not offer a clear link to its function. Similarly, the Block and Guide tool – represented by a filled-in rectangle, and the 'Pause' graphic representing dynamics as well as articulations are not clear.*
	Computer Feedback / Error-Handling ∪ How are errors dealt with ∪ Do they explain what is happening ∪ Do they explain why it is happening ∪ Is it always possible to exit / undo ∪ What is the error rate / Do warning messages interfere with or interrupt the flow of input? ∪ Does the package 'forgive'	*As the package is flexible until intelligence is manually invoked there are not many error messages. Normally, if an error does occur, a beeping sound is made, or the expected result simply does not happen. There is a log, which sometimes appears, and can be accessed at all times through the' Info' menu, but it does not give feedback on the last action(s) or how errors occurred. Formatting is the biggest cause of serious errors. If voicings are not entered correctly, attempting a 'Format to Width' or pagination can result in a totally messed up page, with no recourse to undo.* ***The** package is flexible, therefore the error rate is minimal. There are very few forced actions, and <u>Calliope</u> allows the user to be in control for the majority of actions.* ***There** is no undo facility – operations have to be deleted and restarted if an error occurs – and the package is not very user-friendly, especially concerning novice users, therefore it is not very forgiving.*
	Subjective Satisfaction ∪ On first approach ∪ Overall ∪ Specific elements which affected experience ∪ Other user's experiences of the packages – which they use now, and why	***The** first introduction to the package – through the tutorials – is quite accessible. When starting out, however, I found that it was difficult to remember everything: there is no manual and the help facility is very poor. Also, the fact that systems and staves are separate objects, and are not treated as continuous / a whole, was a difficult concept to grasp at first – especially concerning page format, set-up and layout. However once these problems were overcome the package was logically organised and quite straightforward to use.* ***Overall** I feel that the package produces professional results and is especially proficient concerning older notations – medieval in particular. In order to achieve high quality results efficiently and effectively, however, it is necessary to be very organised and input as much with each tool as possible – so that the flow of input is not interrupted: it is a mainly mouse-based package, and as such, swapping tools frequently can be very time consuming. I feel that it is not particularly accessible to a wide range of users, and although it tries to cater for the novice user it can be quite an intimidating package at first as there is no feedback and it is not very forgiving. It copes well with manipulations to produce guitar and avant-garde notations, especially as it is not really designed for them, but input can be quite a slow process at times as the package is mouse-oriented – is not 'drag and drop' – and there is no undo facility.* ***Positive** elements include: flexibility and lack of interruption (once used to it); easy copy and paste into text documents; proficiency in numeric lute tablature and older notations; and the ability to manipulate existing notations to produce good results for guitar and avant-garde notations. More negative elements include: poor quality help; lack of undo; and poor accessibility to novice users.* ***For** other users' experiences of <u>Calliope</u> please see Appendix 1.*

Practical Acceptability	Calliope
Cost	***Calliope*** *is a free package. As it says in the 'Info Panel': 'You may use this software free of charge, but you may not share it with other sites. Only copies obtained directly from the author are legal. (…) The availability and free distribution of Calliope does not convey or imply a license for resale.'*
Compatibility ü With other platforms ü With other programmes	***This*** *package operates on platforms with a NeXTStep system on PC and NeXTStep hardware, and it really only offers support for* ___Calliope___ *files.*
Reliability ü Crashing ü Suppliers help	***The*** *package crashed once while I was evaluating the part extraction facility, and several times while attempting playback. Overall it is very stable.* ***There*** *is no real 'help' within the package apart for the tutorials, however the author has been extremely approachable by email, and is very responsive to adding features, fixing bugs and advising.*

2.1.2 Specific Higher Education / Multi-user Results

HE / Multi-user Specific	Calliope
Creation, Communication and Dissemination of music Ranges and Quality of Input / Output: ü Playback ü Visual ü Keyboard ü Midi / Sequencer ü Score Scanning / OMCR ü Other Types of Input ü All types of music – 'traditional' to 'modern' ü Handling of large scores. ü Support for collaboration / transfer between other programmes: music and text ü Professional result for publications (analytical, research and other)	***Playback*** *using the NeXT internal DSP engine is not reliable on NeXTStep. It is possible to connect an external MIDI interface on NeXT hardware, or use certain sound cards (e.g. Turtle Beach Pinnacle) on Intel hardware, to provide stable, standard General MIDI playback. As the FAQ section says: 'Owing to problems concerning memory allocation for the NeXTStep driver, audio output using the internal DSP orchestra is not reliable. It is easily overloaded, and the orchestra runs late. The DSP driver often hangs the* ___Calliope___ *process, and is not recommended. This is a problem with NeXT DSP driver software, not with* ___Calliope___ *or the MusicKit. The General MIDI option works perfectly, and is recommended for all audio playback' (Tutorials: FAQ).* ***The*** *following is only in relation to suing the internal DSP for playback: general MIDI playback does not suffer from these problems. The playback facility is located under the 'Perform' in the Tools menu. When attempted it had a tendency to crash, and attaining playback of any sort can be quite a delicate and temperamental operation. If 'All notes' is selected, then playback occurs for around one bar and then will stop. If the stop button is then activated, the programme hangs and needs to be shut down. Alternatively, if the 'Selected notes' option is activated then it becomes possible to play small sections of the music – building up to large sections by highlighting notes individually with the mouse and then activating the play facility. It is also important to match the 'Play from' feature correctly to either 'System', 'Doc' or 'Page' in relation to your score so that playback can be achieved. It is also possible to adjust the 'Tempo', 'Output' device, 'Channels', 'Recording' options and to 'Disable programme change'. The features offered under 'Channels' seem to allow for spacialisation – adjustments can be made to the: number of channels used; 'Level'; 'Bearing'; 'Reverb'; 'Chorus'; and 'Vibrato', and solo and mute can be achieved by using the 'Selected notes' option. Playback is not linked to features in the score: items such as forte and staccato are not realised.* ***Magnification*** *ranges from 50% – 400%. On-screen quality is good at high magnifications, however there is a need to manually adjust the size of the window. At 100% the screen view is a bit small, but accurate input of notes is quite easy – due to the 'cross' cursor. At 87% lines become uneven but input is still possible, at 75% staff lines appear very evenly spaced, but accurate input is more difficult, and at 50% the screen looks quite smudged. Although only one font is available,* ___Sonata___ *font, it does produce a professional result. Switching between magnifications and pages is done smoothly, cleanly and quickly – no remnants appeared. However remnants did appear when the 'Range' tool was used, and remnants can occur when using the package on slower computers. The need to re-size the window manually when magnifying does interrupt the task in hand. Default settings are correct for solo parts, however slightly too large for instrumental ensembles. Spacing between staves is good for string quartet and solo settings. The tendency is to align everything to the top of the page, which can look strange, and initially leaves a large gap at the bottom of the page. Altering the relevant default settings can change this, however some users find page formatting tricky at times.* ***Midi*** *keyboard input is activated through the 'Perform' menu, wherein MIDI settings such as*

	'Channel' information, and 'Recording' settings such as 'Feedback disabled', 'Duration' of the recorded note to be recognised from tempo of previous note, and enabling the metronome click are found.
	MIDI import and export is available. In order to realise a MIDI file, there needs to be a prepared and appropriate document opened ready to receive the MIDI information. Additional systems are created by the package, and it is possible to use shortcuts to override the assigned note value 'on the fly' (FAQ). The export option is found in the playback menu, wherein it is possible to.
	There are options for shortcuts available and for importing graphic and MIDI files.
	The package caters well for traditional and early music editions. It is not designed for avant-garde or modern guitar notations, but the facilities available can be manipulated to produce good results for these types of notations. Calliope is especially good concerning the older notations – lute and neumatic – and also provides well for figured bass.
	Calliope copes well with alterations of a 15-page piece. Insertions and changes to key and time signature were handled efficiently, however, as the package is page-oriented and each stave is treated separately, insertions and deletions do not induce notes to run-on to another staff unless instructed: meaning that a stave can become quite cramped until manual intervention. The option to print 2-up or 4-up (a standard NeXTStep feature) is an added bonus when printing out lots of pages of music. Part extraction is simple enough in itself and can be achieved using either the 'System Inspector' panel (only extracts parts for the one selected system) or the 'Tools / Parts' menu. However, the score has to be prepared correctly in terms of voicings, assignment of names, abbreviations and MIDI channels relative to the staves. The resultant part extraction opens a new document, with system, stave and part labels, but the set-up for the document needs to be changed as desired. Part extraction allows for a variety of part combinations.
	There is an allowance for saving or copying a region, or the whole score, in EPS or TIFF format. The region to be saved is simply dragged over with the mouse, and then you can 'paste' this directly into a word processor. This enables easy transfer and use of scores, and parts of scores, as graphic images, with text processors. The power of this function should not be underestimated – you can specify the resolution of TIFF images, or use scalable EPS images. There is an 'Open MIDI File' function offered in the 'Developer' menu, wherein if there is a document open with the correct settings in place – time signatures, key signatures – then the package is supposed to open a MIDI file; however I was not able to achieve this. There is also an 'Export MIDI' option available from the 'Playback' menu: again, however, I was able to achieve this only with difficulties. The package can save documents as Calliope files, MIDI files, or MusicKit score files (text based description language). MIDI file output is a bit buggy, and the timing seems to be out of synch with the bars and beats.
	Calliope is designed to be a publications-based programme. As such it allows for publishing-specific as well as regular terms to be used. For example rastral numbers, picas, millimetres and inches can be used for measurements. It produces a good quality, good-looking score, and allows for manipulation of formats and spacing. The 'Adjust to width / design' features can be problematic if you use graphical symbols in the score – which do not make musical sense to the set-up of these features (this can be overcome using the 'column' and 'pack left' features) – and having to remember to manually update / adjust them can hinder the work flow. The ease of selecting parts of the score and saving / copying as a graphic image allow easy insertion of music into text documents. Lute and older scores can be produced to professional quality fairly quickly and easily using Calliope, however it can be quite a slow process to produce a professional result for other types of notations due to the almost solely mouse-based input.
Teaching and Learning Presenting and manipulating in a multi-user learning environment: ᴜ On screen ᴜ Audio ᴜ Tutorials ᴜ Help ᴜ Specific platform advantages for packages that aid teaching	*The package allows for particularly easy copy and paste across packages – music section, to graphic representation, to text package – quickly and easily. Any part of the score can be selected and pasted into a text document on the NeXTStep platform, it does not need to be the whole page.* *The tutorials are located in a separate file from the package, which means that you have to switch between the text package and Calliope. The text in the tutorials is quite small and does not scale, however the tutorials themselves are good, clear, easy to follow and quite comprehensive. They cater for all levels of computer expertise: from how to select a portion of the score, to manipulating it more professionally concerning publication conventions (prefatory staves).* *The help facility is very poor within the package. There is only basic information relating to the platform, and there is no link-up with the tutorials or FAQ documents, which would have been extremely helpful.* *Platform advantages: NeXTStep advantages for teaching and learning include: being able to print 2- and 4-up; the ability to use Screencast to project your screen onto other computer*

	screens; the use of inspectors; and the easy copy and paste facility between Calliope and text packages on the platform.
Research and Development Support for: ᴜ Extension and Expansion ᴜ Fine Tuning ᴜ Collaboration and general standards	***General*** *shortcuts (copy / paste) are available, and there are a few basic music-specific shortcuts available (for note length), however these are quite limited.* ***There*** *is really only support for Calliope files and graphics files – EPS and TIFF, and there is very limited support for MIDI. Although you can save as MusicKit score files (text based), there are few other programs that can deal with these in any meaningful way.*
Installation, Integration and Administration ᴜ Ease of installation in network / multi-user and single workplace environments and ease of administration and licensing.	***As*** *is traditional in a NeXTStep or UNIX environment, Calliope is particularly well suited to use in a networked / multi-user environment. In a NeXT network an application like Calliope can be put on one file server and become immediately accessible to all other NeXTStep machines on that network. Because the shared file system is read-only, there is no way for users to mess up the installation. Over the life of Calliope there have been numerous new versions, so it is a simple matter of replacing the one copy on the network with the new copy, which is then immediately accessible by all users.* ***Calliope's*** *preferences and templates are stored on a per-user basis, inside the user's home area. Thus the entire environment follows a user around the network, no matter which computer they log in on. This also applies to multiple users on a single workstation (non-networked). This is ideal in an academic or publishing network.* ***Calliope*** *is free, and requires no license codes to operate or administer.*
Other Capabilities	***There*** *is the option to save documents or parts of documents as graphical TIFF files.*

2.1.3 Calliope Summary

Calliope is very much at the publishing end of the scale in relation to other notation packages. It is page oriented, and operates with publishing terms in mind. Its forte lies in catering for this and for older notations. Although it is not particularly user-friendly initially, if it were to expand, for example, to allow faster input methods using the keyboard, and if it were to include a help and undo facility, then this package would be able to set its sights on a much wider target audience. It has extremely good capabilities, but these are all too often overshadowed by the intimidation that a novice user can feel when introduced to the package. It should be remembered that this is a free package.

2.2 FINALE 2001 FOR WINDOWS ON PC

2.2.1 Traditional-Criteria Results for System Acceptability

<u>Finale</u> is a 'powerful program for music transcription, notation, playback, and publishing. It incorporates elements of a word processor, a graphics designer, a sequencer, and page-layout program' (Manual: pviii). As such, it combines both the creative and the publishing elements to produce a flexible package that is accessible to a wide range of users. It is not really designed to cater for older notations, such as lute tablature, but can give good results through manipulation of the existing features.

Social Acceptability	Finale
Suitability for Specific User Groups ப Specific languages ப Disabled ப Music specialists ப Novices to the package	***There*** *are translations into German, Japanese, Korean / Chinese, Italian, French, Slovenian and Dutch / Flemish available (*<u>*Finale*</u> *website) in addition to the American-English version. There are also standards platform character encodings and symbols for French, German, and other languages.* ***There*** *are numerous input possibilities, including a MicNotator facility in which input can be made via an acoustic instrument linked to a microphone, and there is also the option to adjust display colour settings for items. The package has good zoom and magnification capabilities and a range of shortcuts and customisation options that may benefit a disabled user.* ***Medieval*** *and older notations are not particularly well catered for, but apart from that, there is a good guitar and avant-garde support, and it is a very flexible package which offers useful features to a wide variety of users. There are also options to write plug-ins and there is a developer's kit available from the website.* ***Tutorials*** *and user support through the Help feature enables the package to be accessible to a wide variety of users. It can be quite difficult, however, to come to terms with the package initially as there are numerous menus to get to grips with. It is not always as instantly accessible to a novice user.*
Advantages / Disadvantages over the 'norm' for a Package of this Type ப Does the package have any special advantage over others of its kind ப Does the package have any disadvantage over others of its kind	***Advantages*** *include: Multiple undo / redo; Sophisticated printing and formatting features; the Guitar features; the built-in Graphics package – which is a unique feature of* <u>*Finale*</u>*; the Message bar, which gives instruction as to the purpose and operation of each of the tools and other features; the Mass Mover / Mass Edit tools; the option to 'create your own' artificial intelligence for the interpretation of symbols and words; the Help button on options boxes; three types of part extraction; the MicNotator and Internet facilities; and the Help buttons on each of the dialog boxes.* ***Disadvantages*** *include: the need to correlate / update and redraw Scroll and Page views; US spellings and defaults which can be confusing at first – although there are good cross-references; the fact that Speedy Frame is the only efficient way to edit items; the graphics package alters every existing similar shape in the score to match when you edit a shape; and some menus only appear when their associated tool has been selected – leading to initial confusion concerning the placement and location of menus.*

Practical Acceptability Usability: Usefulness	Finale
Learnability ப How easy / straightforward is it to learn initially ப Direct manipulation / User control vs. computer control ப Numerical values ப WYSIWYG ப Obvious directives and results visible ப Aesthetic integrity, consistency and reliability – within and between the packages	***The*** *tutorials are an accessible introduction to the package, however initial contact with the package in practice is quite challenging. There is also a Video Tips introduction to the package – the only sound-and-motion introduction encountered – which is a very good way to access and become familiar with the basic functions of the package, and it can also be used for reference purposes. There are numerous menus and tools to come to terms with and use of Scroll and Page views can complicate matters further.* ***Direct*** *manipulation is only really possible during speedy entry, when notes and items can be dragged around – apart from this, it is necessary to have the correct tool highlighted in order to change or alter items. Global manipulations and settings for specific alterations are controlled via the menus, and there is a high use of 'handles' attached to items in the score which can be problematic at times.* ***Numerical*** *values can be input for all formatting, layout and most other options in addition to the drag and position facility. The package is very flexible and powerful and allows for adjustments and control over most items in the score.*

		The operation of both Scroll and Page views insinuate that WYSIWYG is not always in operation. In certain instances, things that were input in scroll view changed and were difficult to manipulate when updated and viewed from Page View. For example, the boxes that I used to partially hide part of the score in the avant-garde example (see Appendix 1) completely altered position, and as they were linked to notes that were sometimes in the page before / after then it became extremely difficult to manipulate and rearrange them correctly in Page view. In another sense though, WYSIWYG did operate insofar as what is seen in Page View being replicated when printed out, and manipulations being immediately represented on-screen.
		The package did respond directly to mouse and menu manipulations, however the use of Page and Scroll view does means that the final result of actions is not always obvious, and selecting the correct tool and menu can be difficult at first. Also, knowing whether to click or double-click to achieve articulations, dynamics and SmartShapes can be ambiguous.
		Standard shortcuts and platform conventions can be used, and menus are logically organised and dialog boxes are clearly laid out. It can be difficult to find all the information pertaining to a note, however items that are linked to the score via handles can be double-clicked on (providing the correct tool is selected) and a type of inspector does appear.
Efficiency ʊ Ease of use: are there extraneous / unnecessary / confusing aspects ʊ Are shortcuts and macros available ʊ Excess number of mouse clicks needed ʊ Templates ʊ Functions which should be automated		*Use* of Page and Scroll views can be confusing at times, however this version has improved the links between the two. Initially the menus and the links between tools and their function can be confusing, as can the 'new menus' that only appear when a specific tool is selected. Also the use of SmartShapes is not always obvious, and although instructions are given in the message bar concerning how they are to be used, they can be difficult to master.
		There are a wide variety of shortcuts available: traditional, self-created and music-specific, and there is an option to develop and create plug-ins. Macros are available and can be created by programming Metatools for individual tools.
		At times there can be a necessity to go through various menus or dialog boxes to get an outcome – reaching and creating a graphic in the in-built graphics designer, for example – and the necessity to select a tool to get access to a menu can be confusing.
		A wide variety of professional-looking templates are provided and organised into folders. The 'Band' folder encompasses, for example, 'Brass', 'Jazz', 'Wind' and 'Marching Band' templates. The 'Choral' folder contains templates like 'SATB with Piano' and 'Barbershop Male'. 'Handbells' and 'Piano and Organ' are examples of those in the 'Church' folder. The 'General' folder has instrumental quartet and duet templates and also contains templates for lead sheets, and the Orchestral folder has items such as full, chamber and string orchestra templates, and there is also a 'Jazz Font Default' template.
		Adding basic items to a score, like clefs, key-signatures and articulations should be readily available without needing to select the correct tool and access a separate dialog box. This may allow for a wide variety of choices to be made, but being presented with all of these options can be confusing and time-inefficient.
Memorability ʊ Aesthetic integrity, consistency and reliability – within and between platforms ʊ Knowledge in the Head and Knowledge in the World		*Standard* platform shortcuts and use of menus is available. Use of menus and tools allows most alterations and settings to be performed, however the package is generally not 'drop and drag', and therefore, the correct tool always has to be assigned in order to get results. Only in Speedy Edit can items be directly manipulated. The menus and options boxes are clearly laid out, although there are numerous tools and menus to get accustomed to and remember if the package is be used efficiently and remembered. There is widespread use of 'handles' for both items in score and formatting / layout, which can hinder memorability insofar as locating and manipulating them.
		Most of the icons and graphical symbols present clear links to their functions. The 'Staff' tool, however, does look more like a clef insertion tool, and the 'Smart Shape' tool is fairly ambiguous, but the Message bar clarifies the tools' names and functions.
Computer Feedback / Error-Handling ʊ How are errors dealt with ʊ Do they explain what is happening ʊ Do they explain why it is happening ʊ Is it always possible to exit / undo ʊ What is the error rate / Do warning messages interfere with or interrupt the flow of input? ʊ Does the package		*The* package is very flexible, and as such there are very few illegal or warning messages incurred: normally nothing happens when something 'illegal' is attempted.
		There is a multiple undo / redo facility available, and there is a listing that can be used to perform multiple undo / redo actions.
		The error-rate is very low as the package is quite flexible and does not interfere too much with the user's actions or decisions. There are very few forced actions.
		I would say that the package is 'forgiving' as multiple undo / redo facility is available, and as the help feature is very accessible and clear.

'forgive'	
Subjective Satisfaction u On first approach u Overall u Specific elements which affected experience u Other user's experiences of the packages – which they use now, and why	*Initially*, I found the tutorials, help, Quick Reference booklet, and especially the Video Tips support to be very clear and well presented, however mastering the use of <u>Finale</u> was more difficult. There are numerous menus, tools and options that the user is faced with which can seem very intimidating initially, and the use of Scroll and Page views adds to this. These options give an indication of the power of the package, however can be slightly difficult to come to terms with at first. *<u>Finale</u>* is a very powerful package that offers a wealth of fine-tuning options which, once mastered, enable professional, camera-ready, scores to be produced. It caters well for a wide variety of notations and users, although it does not provide as well for older notations such as lute tablature. *Positive elements include: the flexibility of the package, and the wealth of options available; the in-built graphics program; the option to create artificial intelligence; the Video Tips; Internet provisions; the in-built scanning programme, and the MicNotator feature. More negative elements include having to update / redraw 'Page View' in order to correlate with 'Scroll View' and the need to master use of tools, menus and shortcuts to operate the package efficiently.* *For* other users' experiences of <u>Finale</u> please see Appendix 1

Practical Acceptability	**Finale**
Cost	*Retail* price: £469 (inc VAT) *Academic* price: £269.08 (inc VAT) *Upgrades:* *from Finale 1.0 to 97* £199.95 (inc VAT) *from Finale 98* £79.95 (inc VAT) *from a 'Qualifying Competitor's Notation Program'* – <u>Encore</u>, <u>Rhapsody</u>, <u>Cubase</u>, <u>Score</u>, <u>Overture</u> or <u>Sibelius</u> £169 (inc VAT) *from Allegro* £149 (inc VAT) *and from PrintMusic!* £199 (inc VAT) *Multi-user* option for Academic users: *5 lab pack with 5 licences* £599 (ex VAT) *There is no other site-licence price for multi-users: it is necessary to buy in multiples of five.* *Information from the Coda Music website.*
Compatibility u With other platforms u With other programmes	*Operates* on Macintosh and PC platforms, and supports <u>Encore</u>, <u>Rhapsody</u>, <u>MusicPresto</u>, and various <u>Finale</u> file formats – Mac and PC, Templates, Finale <u>Allegro</u> and ETFs.
Reliability u Crashing u Suppliers help	*The* package never crashed when I was using it. *Suppliers'* help is provided in the form of the in-built help feature, PDF manual and Video Tips, and via email or the product website.

2.2.2 Specific Higher Education / Multi-user Results

HE / Multi-user Specific	Finale
Creation, Communication and Dissemination of music Ranges and Quality of Input / Output: u Playback u Visual u Keyboard u Midi / Sequencer u Score Scanning / OMCR u Other Input Methods u All types of music – 'traditional' to 'modern' u Handling of large scores. u Support for collaboration / transfer between other programmes: music and text u Professional result for publications (analytical, research and other)	***Playback*** *is very well supported in this package, and there are numerous options that can be selected. Playback enhancements, transpose, mute and solo, and spacialisation options are all available. There are also menu options for scrolling, click and count-off, swing, start and ending options, a 'Listen' option – where the user indicates base click, duration and dynamic settings, and there is an option to set values and parameters for artificial intelligence relating to recognition and interpretation of symbols in the score. Playback adapts and interprets most items in the score, and there is a wide variety of instrumentation available. These can be selected and altered for playback in the 'Instrument List' located in the 'Window' menu. There are also various MIDI options, located in the 'MIDI' menu, which allow alterations to: MIDI channels; MIDI In and Out; 'Sync Master', Import and Export options, allows the sending of MIDI 'Sync'; and sending and altering MIDI 'Values'. There is also further MIDI options available in the 'MIDI Thru Table'.* ***There*** *are good zoom and magnification options, which are not restricted to set increments. Magnification ranges from 5% to 1000%, and there is a good feature to 'View page at previous size'. Although the magnification descends to 5%, it is really only from 25% that the image becomes clearer and less smudged. It is not until 50% that accurate can be achieved and the lines are evenly spaced. Switching and updating views happens quickly, however the screen does tend to 'blink' on and off, and there is the need to automatically update and manually redraw when working between Page and Scroll view. There is an option to alter settings for redrawing in the 'View', 'Redrawing options' menu. The default font is Maestro, and there is a hand-written jazz font available. Default settings and spacings can seem quit large – more suitable for solo rather than ensemble work, however there are numerous formatting options available to alter this, and there is also the option to drag stave and systems into position via system and stave 'handles'.* ***Two*** *methods of keyboard input are available: Speedy Entry and Hyperscribe. With Speedy Entry, the keyboard is used in conjunction with text keyboard shortcuts indicating duration of notes. Hyperscribe enables the user to input music solely using the keyboard – either using a metronome click or a self-created tap (denoting whether the click is to be a certain key on the midi keyboard, or other methods – a foot tap for example) which allows the user to synchronise, at their own speed, the tap and input. This means that the package can slow down and speed up to follow the input of the user.* ***Finale*** *imports, exports and plays back MIDI files, and there is a separate 'MIDI' menu available at all times – see playback.* ***Other*** *input methods include MicNotator – whereby an acoustic instrument linked to a microphone can create input. There are also various shortcuts and importing options available.* ***Finale*** *comes equipped with an in-built scanning package, MIDIScan. The latest version of* ***Finale*** *arrived late-on in our evaluation process and although we were able to evaluate the rest of the package, we were unable to provide a fair and comprehensive evaluation of the scanning features.* ***Finale*** *caters for most types of music: traditional and avant-garde – and there is even a built-in graphics feature and good guitar support. It does not cater as well for older notations such as lute tablature, but manipulation of the existing features allows good results to be produced.* ***Large*** *scores are manipulated easily within Scroll view: insertions, deletions and repagination changes. However it is important to remember to 'Update' in order for these changes to have effect in Page View. Even having done this, I found that I had fifteen staves, but only 11 fit onto the page – leaving the rest off the page – needing to be reformatted. Part extraction is very flexible, there are three types: 'Special Part Extraction', which opens one document with all the necessary part(s) and which is linked to the original document – allowing changes to take place between the score and parts and also saving on file space; 'Splitting into Separate documents', where each part is opened into a separate file, enabling separate manipulation of page format, layout; and the 'Print Parts' command, which automatically prints each part out individually – good if there is no formatting to be done on the individual files.* ***Finale*** *Opens / Saves As* ***Finale*** *Binary and* ***Finale*** *Template files, ETF files and MIDI formats. There is also the option to 'Save as a Web Page', which can then be 'Posted at the Finale Showcase' or 'Distributed on Net4Music'. There are also 'Save All' and 'Close All' options. Imports* ***Encore****,* ***Rhapsody*** *and MIDIScan or SmartScore files, and Reads Windows and Mac version of* ***Finale*** *and* ***Finale Allegro*** *files, MusicProse, and ETF files. It should be*

	noted, however Finale is not backward compatible: it can open older versions, but older versions cannot open Finale 2001.
	Finale can produce very professional-looking, camera-ready scores. It has a multitude of options with which to manipulate files, and there are very sophisticated printing and formatting options available. It is important, however, to remember to check, correlate and update the two views – Page view and Scroll View – in order that nothing unexpected happens when printing. Finale operates from both a publishing and creative viewpoint, and as such, publishing-oriented terms such as rastral numbers, picas and points can be used as measurements in addition to centimetres, inches.
Teaching and Learning Presenting and manipulating in a multi-user learning environment: ᴜ On screen ᴜ Audio ᴜ Tutorials ᴜ Help ᴜ Specific platform advantages for packages that aid teaching	*The 'QuickStart Video Tips' and MicNotator options offered, as well as the various plug-ins for checking range, parallel motion and 'Canonic Utilities', for example, could be of use in a teaching and learning environment..* *Very clear and well presented tutorials, located in a written manual with the installation guide, are very user-friendly and link well to topics in the on-line help for more information. The help and tutorial facilities are accessible to a wide range of users, from novice to more practised users – even when they progress to more technical issues, and the 'QuickStart Video Tips' idea is also very informative, user-friendly and interesting.* *The help from the package is accessible and comprehensive, it should be remembered, though, that it uses American spellings – but there are good cross-references that aid the user in finding the information. The documents are located in PDF format and are accessed through an Adobe Acrobat reader. There is also help available from mast of the dialog boxes, which is very helpful. Both are well laid out and very accessible. The quick reference card is also clear to follow and compacts the necessary shortcuts and operations visually (in music example format) and through a listing.* *Platform advantages: Windows advantages for teaching and learning include the wide variety of multimedia peripheral devices and MIDI and audio soundcards available. There is also the option to use VNC – the Windows version of Screencast.*
Research and Development Support for: ᴜ Extension and Expansion ᴜ Fine Tuning ᴜ Collaboration and general standards	*Numerous plug-ins are available, and there is a developers' kit available from the website. There is also the option to edit plug-ins in the plug-ins menu, and the tutorials encourage users to send in their ideas for new plug-ins and features. The manual also encourages users to link to packages which enable macros to be created, in order to make more efficient use of the package.* *There are mainly traditional / general platform shortcuts available. There are music specific shortcuts, and the tutorial clearly explains how to self-create links and shortcuts to various buttons on the text keyboard.* *There is support for various Finale formats, including ETFs, and for Encore, Rhapsody, MIDI, MusicPresto files.*
Installation, Integration and Administration ᴜ Ease of installation in network / multi-user and single workplace environments and ease of administration and licensing.	*Coda software obviously takes software piracy very seriously, and has various schemes for ensuring copy protection. The copy the evaluators purchased used a scheme whereby every so often Finale will ask that the installation CDROM be inserted before it will continue. If you don't have the CDROM, it will allow the user about 6 chances before Finale will refuse to run at all.* *In our multi-workstation setup we had tested the installation on two separate machines, one of which was in a student lab. Inevitably, the CDROM went missing, and there was absolutely no way to get a replacement CDROM, except for re-purchasing the entire package or an upgrade! As well as hindering this study, the incident proved what an ill-suited scheme this is for managing copy protection in an uncontrolled environment. We don't like it.* *In line with most Windows applications and networks, there seemed to be no easy way to make a network-accessible installation of Finale. Even if it were technically possible, Finale's licence prohibits it. Installing / upgrading Finale on all machines in a network would require doing so on each individual machine.*
Other Capabilities	*Finale offers an option to 'Save [files] As Web Page' . This allows the user to create, save and view their music on the Internet. Finale also offers the chance to post your files on the 'Finale Showcase' at the Finale Website, and to publish your piece using 'Distribute on Net4Music'. As we did not have access to the latest version of Finale until late-on in our evaluation process, and although we were able to evaluate the rest of the package, we were unable to provide a fair and comprehensive evaluation of these Internet options..*

2.2.3 Finale Summary

Finale offers a wide range of features to a wide range of users. It offers professional publishing capabilities as well as allowing use from a more intuitive and composer-oriented stance, and as such lies almost mid-way between publishing and engraving centric packages on one hand, and the more user-

oriented compositional packages on the other. This results in a wide variety of options for the user, and therefore, in a wealth of menu and tool features, which can make it more difficult to learn initially, and the marrying of 'Page' and 'Scroll' views can also be confusing. The scanning, Internet and playback capabilities enhance its attractiveness, and, all-in-all, although expensive, it is a very well-rounded package that once mastered caters well for a wide variety of users.

2.3   NIGHTINGALE 3.5 FOR MAC OS

2.3.1 Traditional-Criteria Results for System Acceptability

Nightingale is a music notation package that starts from the premise of the music engraver. This means that the package is designed to work with music publishing packages, and in line with music engravers techniques. For example, music publishing terms like rastral numbers, standard engraver staff sizes as default, and measurements in 'points' are used, and there is also an 'Engravers' option in the 'Preferences' menu to customise and define the slope of beams, length of stems. Operating from this premise means that items on screen are independent of one another, systems, staves and pages are not linked, and as such, notes from one system to the other are not linked in the package unless manually instructed.

As the package operates from a visual perspective, rather than a compositional one, the notes and symbols on the screen do not need to make sense musically unless instructed to do so by the user. One example of this is the 'View / Show Durations Problems' option which highlights bars in which the time signature and the note durations in the bar do not match – otherwise this is ignored. Another example is the 'Master Page' used to set-up the layout of each of the pages. This is especially rooted in the publishing world and the option to save as PostScript is designed to allow scores to be exported into various packages, including professional publishing packages such as Quark and PageMaker.

It is not particularly designed for avant-garde notations, and it only caters for guitar music through chord symbols, not TAB. It does offer options for special notations such as 'Messiaen-style clusters and chords', and it also offers old notation clefs and the like: French violin Clefs; C Clefs; Baritone clefs; Ligature and coloratura brackets; Scordatura and Incipits; Gregorian Chant; and music without barlines. These, however, really involve manipulation of the existing features using the customising options, rather than catering individually for each. They do, however, provide the visual look and feel of the music desired.

Social Acceptability	Nightingale
Suitability for Specific User Groups ᴜ Specific languages ᴜ Disabled ᴜ Music specialists ᴜ Novices to the package	***The*** *package is English-oriented, but does offer standard character encodings and symbols for French, German and other languages.* ***The*** *shortcuts available are useful, but the package does not offer any specific advantages for disabled users.* ***It*** *does not cater for composers wishing to use guitar TAB – only chords, and is not particularly suitable for someone wanting to develop the package: although the 'NightCustomizer' and 'Get Info' allow for tailoring the package to a good extent. It is also not really designed to cater for avant-garde notations requiring partially hidden staves, although it can hide objects and import graphics and offers support for complicated tuplets. Older notations are not specifically catered for, although certain clefs are available.* *Nightingale is quite a straightforward package, however use of Master Pages, and the fact that systems are independent of one another, and also that formatting needs to be manipulated manually, can be confusing initially – especially for a novice user, as this is not really in line with 'musical' sense, more so with visual attributes.*
Advantages / Disadvantages over the 'norm' for a Package of this Type ᴜ Does the package have any special advantage over others of its kind ᴜ Does the package have any disadvantage over others of its kind	***Advantages****: It is designed to operate with publishing packages and terms. Options to customise and tailor the package using 'NightCustomizer' – to customize default settings, 'Get Info' – which acts like an Inspector – and 'Quick Change', which allows special and group editing. The ability to see and alter the 'Sync Lines' aligning items within systems, and easy grouping and beaming are also good features. There is also the useful facility of having a temporary working page – representing a musical pasteboard – in operation.* ***Disadvantages****: Independent systems, meaning manual formatting and reformatting is necessary. Limited and basic input and notation options. Jagged, bitmap image on screen especially prevalent at larger magnifications. Single undo facility. The use of trills and articulations as 'modifiers' does mean that they are there as graphical symbols and not really as part of the music, as such they can be tricky to manipulate and get used to at first.*

Practical Acceptability Usability: Usefulness	Nightingale
Learnability ʊ How easy / straightforward is it to learn initially ʊ Direct manipulation / User control vs. computer control ʊ Numerical values ʊ WYSIWYG ʊ Obvious directives and results visible ʊ Aesthetic integrity, consistency and reliability – within and between the packages	*Nightingale is a very straightforward package and is quite easy to learn. The tutorial documents seem to be designed ideally for print out rather than to be read on screen. Nevertheless, they present the information clearly and there is good use of illustrations showing the menus. As the package operates from a publishing viewpoint, it can be quite intimidating for a novice user in the sense that they have to set-up and layout the document within a Master Page – a publishing convention, and also the staves and notes within them are independent of other staves, meaning that formatting and changes to formatting must be done manually: notes do not flow between systems.* *Direct manipulation in the package is mainly done through the mouse. There are shortcuts that can be activated easily, but most of the input is done in conjunction with the mouse. The toolbar offers the insertion of most symbols, and shortcuts allow for altering them – adding sharps and flats, changing the cursor without manually selecting form the toolbar. The drop down menus offer global and highly specific alterations. For example, 'Get Info' allows for very detailed adjustments and fine tuning of individual items highlighted on the screen – horizontal and vertical positioning, MIDI information, stem information, staff number, and 'Quick Change' enables modifications concerning notes, barlines, clefs, ties, allowing attribute changes – accidental, type, size, staff. There are other specific formatting and page layout options available in the drop down menus which allow options for the entire document: the 'Master Page', and preferences – for engraver, document and file options, and 'Score Info'. There is also a 'NightCutomizer' option located outwith the package, which allows for tailoring the whole package and customising defaults to individual requirements. It is important to note that items such as trills, dynamics, mordents, turns are classed as 'Note modifiers' and as such, they exist only in relation to the note to which they are attached. There are handles that link the note and the symbol, but they can be easily manipulated – to a certain extent – through the dragging arrow, so they can also be directly manipulated.* *Numerical values can be input for virtually all aspects of the package – notes and symbols, layout and format – as there are numerous menus allowing for minute adjustments to the positioning and character of items and defaults.* *What you seen on screen is an authentic representation of what the printout will look like, however the bitmap image is much more jagged than the printout. Also, input and adjustment actions made using the mouse, keyboard or menus is automatically represented on screen, and if the resulted action does not happen, then there is normally a warning or explanatory message.* *The screen reacts to input and adjustments immediately, and the package gives very good feedback concerning whether an action has, or has not, been achieved and why.* *The package uses standard shortcuts and platform conventions. Shortcuts are always indicated beside the corresponding item on the menu, if available. The menus are logically organised and clearly laid out, and it is very easy to find and alter the information pertaining to a note, rest.*
Efficiency ʊ Ease of use: are there extraneous / unnecessary / confusing aspects ʊ Are shortcuts and macros available ʊ Excess number of mouse clicks needed ʊ Templates ʊ Functions which should be automated	*The use of Master Pages is unique to this music package, and can be difficult to get used to, although it operates similarly to a template. Working with independent systems can also be tricky to get used to, as can only having a single-undo facility.* *There are single-key shortcuts – linked to the toolbar – available for use with mouse and keyboard input, and standard platform shortcuts are available: general and music-specific.* *There are various templates provided in Nightingale: orchestral, choral, big band, jazz ensemble, string quartet, saxophone quartet, brass quintet, barbershop, and there is also a template for exporting a small example to a text document (through EPS). These are well laid out, and the defaults and formattings are good.*
Memorability ʊ Aesthetic integrity, consistency and reliability – within and between platforms ʊ Knowledge in the Head and Knowledge in the World	*There is clarity, consistency and a logical order concerning the layout and formatting of the menus and the package uses standard platform conventions and general shortcuts. The mouse is used to input items, the menus manipulate and change objects and adjust the formatting and layout of the document both specifically and globally – with reference to publishing and engraver conventions. There is a further option for tailoring of the package through the 'NightCustomizer'. Music-specific shortcuts can also be used to manipulate notes. The menus and dialog boxes are logically laid out, and information is consistent and easy to access and change.* *Although most tools and functions are obvious, the 'Threader' tool, symbolised by a pointing finger icon, does not provide an obvious link to its function – allowing individual items to be highlighted with one click. Similarly, the 'Insert Space' icon – a planet with stars around it – and the 'Dragging' tool – a filled-in arrow – do not give ideal visual references.*

Computer Feedback / Error - Handling	
ʊ How are errors dealt with ʊ Do they explain what is happening ʊ Do they explain why it is happening ʊ Is it always possible to exit / undo ʊ What is the error rate / Do warning messages interfere with or interrupt the flow of input? ʊ Does the package 'forgive'	***Errors*** *occur when an illegal action is performed. An error message normally appears to indicate this, and the action is not completed.* ***Good*** *explanations and reasonings are given as to why the action has not been performed, for example: 'Nightingale can't handle chords containing unisons'.* ***There*** *is a low-to-medium error rate with this package, as it allows flexibility and fine tuning but is not as advanced functionally as some of the other main packages. Most of the errors occurring are caught by the system and the user is provided with useful messages* ***Nightingale*** *is not that forgiving a package as there is only a single undo facility, however the explanations given in the error messages do help the user to understand how the package operates. The package recognises its own weaknesses and is not afraid to highlight and explain them.*
Subjective Satisfaction	
ʊ On first approach ʊ Overall ʊ Specific elements which affected experience ʊ Other user's experiences of the packages – which they use now, and why	***The*** *tutorials and the help facility make the package accessible to all users. They provide a good introduction to the package, and give support during the learning process. Initially it seems quite a basic package, but there is a wealth of fine-tuning capabilities within the package. The menus are very logically organised, so finding information is not a problem, and the Users' Guide and help are also very accessible.* ***Overall***, *I feel that although the package does not have some of the advanced features found in other packages, and although it does not cater as well for as wide a selection of notations, Nightingale can produce good-looking results with some fine tuning, and it offers a lot of scope for tailoring the package to individual needs. It is publishing and engraver oriented and this is concerned with the look and feel of the document rather than helping the user to create, which means that it is not as immediately accessible as some of the other packages.* ***Positive*** *elements include the options for fine tuning and the links with publishing software packages, as well as the option to scan music and the feedback given by error messages. More negative elements such as: not catering for all types of music, manual formatting and the single undo facility did affect the positive experience of the package slightly.* ***For*** *other users' experiences of Nightingale please see Appendix 1.*

Practical Acceptability	Nightingale
Cost	***Retail*** *price:* $59 for first time buyers plus $15 additional for shipping and handling for the UK.* *$2 extra for every additional disk.* ***Multi*** -*site licences:* *3 – 5 licenses* *15% discount for* *6 – 10 licenses* *25% discount*
Compatibility ʊ With other platforms ʊ With other programmes	***Nightingale*** *operates on both Mac and PC. It offers a 'Save As PostScript' option and the various converters – to Adobe Illustrator and NoteView – which allow it to be compatible with publishing packages such as PageMaker and Quark Express, as well as with text processors and other packages. It supports and allows Finale ETF files to be imported, and supports Notelist and scanning functions.*
Reliability ʊ Consistency ʊ Crashing ʊ Suppliers help	***The*** *package never crashed whilst I was using it.* ***The*** *on-screen help was very good, as was the search facility provided in the online Users' Guide. The supplier was helpful concerning information, and was very approachable by email.*

2.3.2 Specific Higher Education / Multi-user Results

HE / Multi-user Specific	Nightingale
Creation, Communication and Dissemination of music	***The*** *playback facility provides quite regular features such as playing the entire score, a section of it, and continuing from where the play stopped, however one good feature is that you can stop playback by clicking with the mouse, and input can continue via an entry cursor*

Ranges and Quality of Input / Output: ᵾ Playback ᵾ Visual ᵾ Keyboard ᵾ Midi / Sequencer ᵾ Score Scanning / OMCR ᵾ Other Input Methods ᵾ All types of music – 'traditional' to 'modern' ᵾ Handling of large scores. ᵾ Support for collaboration / transfer between other programmes: music and text ᵾ Professional result for publications (analytical, research and other)	*at the stop position. Mute and solo options are not available, however they can be achieved by manipulating existing features: either setting the pianissimo volume to 1 and applying that to the score and inserting the pianissimo symbol at the start of the score, or by highlighting the section(s) to be muted and changing their 'Velocity' to '0' in the 'Quick Change' menu. Standard MIDI and audio preferences can be set for playback such as: 'Turn Pages while Playing'; Metronome options; and Patch, Balance and Velocity instructions. There is also a facility for recognising and interpreting the MIDI velocity for dynamics and tempo in the score, and it is possible to set individual dynamics tables for each instrument indicating their MIDI settings for dynamics. When altering dynamics, it is necessary to indicate whether you want this setting to apply to the score, otherwise they will only refer to new notes. All invisible / hidden items are heard during playback, however 'Note Modifiers' – trills, mordents, articulations – are not recognised in playback. It is possible to manipulate individual settings for notes and other entries in the 'Quick Change' and 'Durations for Playback' menus. For example, lowering percentages for durations results in an audio staccato. It is also possible to hear an audio transposition of the score during playback without affecting the score. Regular transposition is available which relates to the initial settings put in place for instruments and parts in the 'Master Page' containing MIDI instructions and transposition information as well as part names and abbreviations.* **There** *are enlarge and reduce, as well as 25% to 600% zoom and magnification options available. The zoom increments are fixed: 25%, 38%, 50%, 75%, however the lines on the stave are not even until 50%, and accurate input is only available from 75% onwards due to the size of the 'note' cursor. All spacings between lines are even from this percentage on. It takes under a second to switch views, and there are no graphical remnants on screen when you do this. There were graphical remnants, however, and the screen had to be manually redrawn – using the redraw command in the 'View' menu – when some items were deleted. The page uses bitmapped graphics that do not scale well, and objects on the screen can look jaggy. There are three fonts available: Sonata; BlueNotz; and JazzFont. Sonata is the default font. It is a traditional, elegant-looking font, and BlueNotz and JazzFont are hand-script style music fonts suitable for jazz and other scores. The default spacings and note sizes for scores are a bit large: good for solo parts, but a bit too big and spaced out for ensemble scores. Alignment is to the top margin of the score and I was unable to find a global way to alter this, apart from changing the margins or manually dragging the staves / systems up and down in the 'Master Page'.* *There are two MIDI keyboard input methods: 'Step Time' and 'Real Time'. Both can be either: recorded and merged (with existing bars in the score); or recorded and inserted (creating and inserting new bars) into an existing score. 'Step Time' recording is achieved by pressing a note on the keyboard and a selecting a corresponding value either through the mouse, or by pressing a shortcut, which can be done at the users' pace. This input is quite straightforward, although co-ordinating shortcuts / mouse and keyboard input can be tricky at first. It needs to be remembered that staves / pages need to be present to record into with Step Time input. 'Real Time' entry, on the other hand, is regulated by metronome speed: wherein pitch, duration and tempo information is input through the keyboard, and is then interpreted by Nightingale. Recording can be selected as 'At concert pitch' or transposed. After recording it is necessary to quantize using the 'Transcribe recording' option in the 'Play / Record' menu, but a dialog box normally automatically follows the Real Time input to achieve this after input.* **Importing**, *Exporting and playback of MIDI files is available. Nightingale exports files as SMF, and creates and accepts Type 1 MIDI files. When importing, options to adjust the quantization, triplets, beaming, clef changes and the number of bars to be transcribed are available. There is also an options box that gives MIDI information concerning the number and type of notes. The resultant score is quite well laid out, but not all MIDI information seems to be interpreted correctly, and unwanted rests or ignorance of accidentals can occur. Also, note modifiers – dynamics, articulations, trills, grace notes – are not placed in the score.* **There** *is a scanning package recommended: NoteScan from Musicware Inc. Nightingale opens NoteScan files, and the package can be purchased separately from Musicware. As this is not an in-built feature of this package we were unable to test its capabilities.* **Other** *input methods include text keyboard shortcuts.* **Nightingale** *mostly caters for traditional-style music. It does offer chord fingerboard symbols and alternative noteheads for percussion and guitar music, but it does not feature guitar TAB. It is not possible with this version to have a stave of more than five lines, although it is possible to draw-in lines and align them with the stave to give the effect of a six or more lined staff. There are no noteheads available especially appropriate for older notations, although there is the option to manipulate various clefs. It is possible to make objects invisible, have complicated tuplets, import graphics, and to draw basic lines, however it is not really designed with avant-garde notations / partially hidden scores in mind.*

	As the package is page-oriented, and staves, systems and pages are independent, insertions and deletions only affect the system in which they occur, which reformats and adjusts staves and bars as necessary. The whole document / page does not reformat automatically as it is not affected unless manually instructed: in the on-line manual it is given the analogy of a 'spellchecker' which is not concerned with the number of beats unless asked to check. This means that staves can get quite cramped looking, and it is necessary to use the 'Reformat measures' and 'Reformat systems' options in the 'Score' menu before justifying the system to manually adjust and reformat the page accordingly. Systems and pages need to be inserted manually, and notes do not flow from one to the other. Part extraction allows for the extraction of 'Unnamed' parts or the extraction of all parts. Each part is opened into a new file, which can be left open or saved immediately. There is also the option to 'Respace and reformat' the parts to a size (percentage) smaller than the original. Multi-rests are not automatically inserted, and the file has to be manipulated once it is open. In order to extract two staves together onto the one page, it is necessary to use the 'SHIFT-click' method to select the parts individually. *Nightingale allows for saving as: 'Notelist'; PostScript – one page as an EPS graphic or the whole file as PostScript text; and saving as a Nightingale file. It offers import and export options for MIDI files, and opens NoteScan, Finale ETF and Notelist files. It offers an 'Open read only' facility, and ut also has a 'Nightingale to NoteView' converter and a 'Nightingale to Adobe Illustrator' converter, which allow easy transferral of information to other packages.* *It is possible to produce good-looking scores for traditional and guitar music – including fretboards, but not TAB unless imported as a graphic image. The on-screen image looks quite jaggy, but prints out well, especially using PostScript. In some cases, however, the barlines do not reach the edge of the stave, and there is a small overhang of stave lines. It allows for using music examples and exporting them as EPS or PostScript into text processors, and has a template set up for this. As it operates from a page-oriented set-up, manual instructions have to be given to adjust the formatting, and to spill and lay systems, bars and pages. It has a good capacity for adjusting and tailoring the format of the document or the package to individual requirements through the 'Quick Change', 'Get Info' and 'NightCustomizer' features.*
Teaching and Learning Presenting and manipulating in a multi-user learning environment: ʊ On screen ʊ Audio ʊ Tutorials ʊ Help ʊ Specific platform advantages for packages that aid teaching	*The options to 'Show duration problems' and 'Show sync lines' are useful as they highlight potential problem areas. As Nightingale does not impose any musical sense unless asked, it can be quite flexible, but the 'show duration problems' highlights bars in which there are, for example, conflicts between the notation and the time signature. 'Show sync lines' shows how the notes align with one another. It is a clear way to see why layout and formatting options do not seem correct – audibly or visually. The sync lines and the notes can be adjusted, but it can get a bit tricky to manipulate them.* *The package can transpose and playback music without altering the score, and it is possible for the user to input music via a MIDI keyboard at their own pace, however there are no specific audio advantages apart from this that aid teaching and learning.* *The tutorials, in PDF format, are located in a separate folder from the package, and are well laid out and easy to follow. They are not as solidly structured as some other tutorials insofar as they offer a lot of freedom to move to other sections and links without being very systematic.* *The help within the package – located in the Apple menu – is well laid out in lists of topics. This is easy to follow, but is not comprehensive. Additional help can be found in the Users' Guide, located outwith the package, which is very comprehensive. It can be tricky, however, to move back and forward between topics as the buttons link to the information rather than the main pages, therefore you can go back five or six pages before you come to a base page, or you have to continually start from the contents page time after time. There is a 'Help History' box, however, that lists, and links to, all the pages you have visited, making it easier to jump back and forth. These are both linked to the search facility, which ensures that it is comprehensive and accessible. It would have been helpful if there was a manual or memory card to encapsulate what was given in the tutorials, but it was easy to get information from the Users' Guide and help. The fact that there are three different types of help – unlinked and in different formats – might make it difficult for beginners to know where to turn.* *Platform advantages: Mac advantages include more 'plug and play' capabilities, which in general, work without any problems, and the user interface is more thought through and friendly.*
Research and Development Support for: ʊ Extension and Expansion	*There is no support for plug-ins. within the package, however there is support for Notelist which, according to the on-line manual: 'creates a text listing of any set of selected symbols in your score. The selected symbols do not have to be continuous. The result is a text file on disk. The text listing is useful for translating the musical information in your score into other formats, such as score lists for music synthesis or data files for theoretical analysis.'*

u Fine Tuning u Collaboration and general standards	*There is no option to create plug-ins within the package, but there are numerous shortcuts available. There is a NightCustomizer feature outwith the package that allows the user to specify package preferences and tailor the whole package to their individual requirements. Options to adjust: 'General Preferences'; 'Engraver Preferences'; 'MIDI Preferences'; 'Postscript Preferences'; 'Instruments'; 'MIDI dynamics'; 'Spacing Tables'; and 'Palette Keymaps' are available here.* *__Nightingale__ supports EPS, PostScript, __NoteScan__, __Finale__ ETF, MIDI and __Notelist__ files. It also offers support for Adobe __Illustrator__ and __NoteView__ file formats, enabling transferral of information with other programmes such as __PageMaker__ and __Quark Express__.*
Installation, Integration and Administration u Ease of installation in network / multi-user and single workplace environments and ease of administration and licensing.	*Nightingale runs in a single use modus. .*
Other Capabilities	*__Internet__ publishing capabilities are not available.*

2.3.3 Nightingale Summary

Nightingale is located, similar to Calliope, at the publishing end of the scale. It operates on 'Master Pages', and is designed for use with publishing packages like PageMaker and Quark. Initially it may seem quite a basic package, but there is a wealth of customisation offered within the package and also outwith via NightCustomizer, and the option to use scanning facilities adds to its attraction. It is easily accessible by a wide range of users, and can provide a good alternative to some of the bigger, more expensive, packages.

2.4   NOTEABILITY PRO VERSION 1.044 ON OPENSTEP FOR PC

2.4.1 Traditional-Criteria Results for System Acceptability

According to the manufacturer: 'NoteAbility is a music notation application for (…) computers that is page-oriented in design, and emphasises flexible graphical control of music images, intelligent automation of notational syntax, WYSIWYG display and an accessible and direct user interface.' Aspects of the page-oriented design can be seen in: the facility to input a note at any point in the score in any order, on top of / at the same point as other notes; having to manually move from page to page; operating with beats and parts of beats from the control panel rather than notes; linked to the above, and use of the 'Move entry' cursor.

The package is not really designed to cater for avant-garde scores, guitar, or medieval notations – although it does have a good lute tablature feature and allows for colours, graphics and simple shapes in a score, and manipulation of the existing features can produce good results.

Social Acceptability	NoteAbility
Suitability for Specific User Groups ᴜ Specific languages ᴜ Disabled ᴜ Music specialists ᴜ Novices to the package	*NoteAbility is English-oriented, but does offer the standard character encodings and symbols for French, German and other languages.* *The magnification feature is not very good, however the 'QuickScrawl' – where moving the mouse in precise ways, linked to directional movements, enables the creation of notes, durations – input might provide an alternative to the mouse. Also, the option to use colour could enhance use for various users.* *NoteAbility does not really cater for those wanting to develop the package through programming or plug-ins, and it is not designed to cater for guitar or avant-garde composers. It does offer a lute tablature feature, which is quite easy to pick up, but there are no other older notations catered for apart form this.* *The 'help' introduction is good, however there are a lot of drop-down menus to come to terms with, and the initial set-up box can be quite intimidating for a novice user. In this respect I would say that NoteAbility is accessible to all, but has a rather high learning curve.*
Advantages / Disadvantages over the 'norm' for a Package of this Type ᴜ Does the package have any special advantage over others of its kind ᴜ Does the package have any disadvantage over others of its kind	*Advantages: It is very flexible, and there is a wealth of options concerning all areas of formatting, set-up and layout. Basic graphic shapes and the option for colour are included in the package. There is a unique 'QuickScrawl' facility and the ability to print 2- and 4-up* are useful features. Creation of triplets is simple, there is an unusual way to draw slurs in the package, which feels very natural once accustomed to it, and there are also four different past commands available: 'Paste Into'; 'Paste Exact'; 'Paste Over'; and 'Insert'.* *Disadvantages: Only a single-undo facility provided, and this is mainly for editing functions – not formatting. The need to have the 'Insert image' cursor highlighted in addition to the note length in order to input notes. Crashing was experienced while: inserting / deleting a blank measure; not saving an extracted part; deleting the last page for a second time; inserting when there were not sufficient bars created; closing the Guido settings box; trying to load a template; and when creating a new document after opening an existing one. In our version, the package always crashed when closing the only file left open. It is not possible to resize the tool box, which can result in quite a cluttered screen, it is not possible to use the delete button, and accidentals do not seem to be taken into account in formatting options – they can be quite crushed against other notes making them difficult to read.* ** This is platform specific.*

Practical Acceptability Usability: Usefulness	NoteAbility
Learnability ᴜ How easy / straightforward is it to learn initially ᴜ Direct manipulation / User control vs. computer	*The introduction is very helpful, and as a result, the package help, linked to it, is quite good – however it would be helpful to have a manual or summary guide / card with listings as there are numerous drop-down menus and the shortcuts can be quite tricky to remember. Also, the 'Find' option in the 'Help' menu only searches the section highlighted in the table of contents, and not the whole table or index, meaning that information was sometimes hard to find. I found that the placement of menus was quite logical and easy to find, and the*

	control	*information in them was well laid out and clear. A novice user, however, might find these menus intimidating at first, especially as the initial 'Document set-up' box looks so complicated initially.*
∪	Numerical values	
∪	WYSIWYG	
∪	Obvious directives and results visible	*Most adjustments to an individual item are done using the 'Inspector' and 'Control' panels, and global attributes can be changed from the main menu. Although direct manipulation is not possible insofar as it is not possible to click on a note and drag it directly without using the 'Entry' cursor, the user is normally always in control using the tools in the 'Control Panel'. Nothing is attached or linked to the score, apart from text, and as such everything can be manipulated.*
∪	Aesthetic integrity, consistency and reliability – within and between the packages	
		Numerical values are available for: most page and music formatting options, and for measuring, selecting or counting bars, parts of bars, systems, voices. Other alternatives include either use of a slider scale (tempo, note density) or selection / highlighting activating or deactivating options (most items in the 'Modify', 'Format', 'Edit' and 'Inspector' menus).
		The package is page-oriented. The output on screen imitates the printed output. When on-screen manipulations and adjustments are made using the mouse or shortcuts there are normally reflected immediately.
		Actions are normally immediately represented on-screen. There are very few error messages or forced actions, however the package does crash when asked to perform various tasks.
		The 'Inspector' and 'Control' panels provide specific adjustments, while the other menus offer global adjustments. These are the only ways in which to manipulate an item (apart from dragging with the mouse), therefore the user knows that information and adjustments are all made in these menus. Also, standard platform shortcuts and conventions are used. There are, however, options in the 'Info' menu that I would not have expected, and which detract from the aesthetic integrity slightly: the 'Image list' – showing shortcuts for notes and other items in the score – I would have expected to be in the 'Tools' menu; 'Copy Types' – selecting which formats (EPS, TIFF) are used when the 'Copy All' function is enacted – I would have expected within the 'Edit' menu; 'Preferences' option for the document – which I would have expected to find under the 'Document' menu; and the 'tutorial' / introduction is found within the 'Help' box.
	Efficiency	*There is a single undo function, which only relates to editing – and not formatting – functions. It can be difficult to remember to have the 'Insert Image' cursor selected as well as the note value for input. The placement of some functions in the 'Info' menu is unexpected. The 'Entry cursor' is difficult to get used to at first. Ties can only be adjusted by moving the notes to which they are attached, and not individually. The screen flashes and takes a bit of time to redraw / update when any additions or adjustments are made. Also, the package sometimes crashes.*
∪	Ease of use: are there extraneous / unnecessary / confusing aspects	
∪	Are shortcuts and macros	
∪	Excess number of mouse clicks	
∪	Templates	*There are numerous shortcuts available involving CMD plus 'x' – general and music-specific, and there is one self-created shortcut (the 'Hot' button). There are single-key-plus-mouse shortcuts for input of notes, rests which relate to the duration, and not the pitch or placement of the note, and can get quite tricky depending on the way you want the duration represented (typing 'qqqe' means three quarter notes tied together with an eighth note). There is also the facility for 'QuickScrawl', enabling mouse-only shortcuts for notes and rests, pitches and durations, but this can be quite tricky to master initially.*
∪	Functions which should be automated	
		The initial 'Document Setup' box requires the user to select various options before opening a file. Although it is possible to select the default, and adjust the file once opened, the initial impression of the package infers that numerous options have to be decided upon immediately. Also, the 'Inspector' needs to be used for basic input functions such as articulations, accidentals, barlines, key signatures, braces, clefs and time signatures if they are not selected in the initial 'Document Setup' box.
		There are a variety of templates available, located in the same folder but outwith the package: choir, orchestra, piano, piano trio, string quartet and vocal piano. Within our evaluation, and evaluation copy, we were unable to load any templates without crashing the application, and they would not open under the extension name given (nt), this needed to be changed to a regular <u>NoteAbility</u> extension (na). There is also an option to access Scriabin4 font, and there is a NoteAbility Library that contains EPS symbols for: cues; flamenco symbols; guitar chords; orchestra time signatures; percussion mallets; and others such as vibrato, breath and Bartok pizzicato symbols.
		Selection of basic functions such as articulations, accidentals, barlines, key signatures, braces, clefs and time signatures, are not immediately accessible from the 'Control Panel'. It is necessary to use the 'Inspector' menu to access and input these if they are not set in the initial document set-up panel, or if they change through the piece. Also, it should be easier to insert and manipulate notes without having to ensure that the 'Insert Image' cursor is selected and the positioning tool is in the correct place every time.
	Memorability	*Standard platform keyboard functions and shortcuts are available and the majority of*

ʊ Aesthetic integrity, consistency and reliability – within and between platforms ʊ Knowledge in the Head and Knowledge in the World	*specifications are altered through the menus and control panels, except for dragging notes, highlighting and input via the mouse, and there are no handles or attachments. This means that the user knows where all the information should be found. There are a lot of menus, drop-down menus and control panels allowing numerous adjustments to be made, which can make it difficult to remember where things are, and seems quite daunting at frst. Some options are placed in the 'Info' menu that are not expected. The format and layout of the menus is clear and consistent, with sliders, numerical input and radio buttons. The panels are well laid out, but can sometimes look quite wordy, although this helps ensure clarity.* ***The*** *'Insert Image' cursor, a circle with a cross does not provide a particularly good visual reference, neither do various text boxes. For example: a calligraphic 'A' represents 'Page' text; and 'rit.' for 'Measure' text, and there is a 'hangman-style' icon representing beaming. The shortcuts can become quite complicated and hard to remember at times.*
Computer Feedback / Error -Handling ʊ How are errors dealt with ʊ Do they explain what is happening ʊ Do they explain why it is happening ʊ Is it always possible to exit / undo ʊ What is the error rate / Do warning messages interfere with or interrupt the flow of input? ʊ Does the package 'forgive'	***The*** *package is very flexible, however, it does crash quite often, giving error messages with little or no feedback.* ***There*** *is only a single undo function available, which only really applies for editing – not formatting – options.* ***There*** *is a very low error rate, and the package does not interfere with your input very often, except when it crashes. There are very few forced actions and the user is in control for the main.* ***The*** *package is not very forgiving as it crashes and the undo facility is poor.*
Subjective Satisfaction ʊ On first approach ʊ Overall ʊ Specific elements which affected experience ʊ Other user's experiences of the packages – which they use now, and why	***I*** *found <u>NoteAbility</u> to be quite accessible – the introduction is clear and easy to follow, and as a result the help facility linked with it is good. There are a lot of menus to use however, and the multitude of drop-down panels was quite tricky to learn. These are organised quite logically though, and the package is straightforward to use.* ***Overall*** *I think that this is a very flexible package with extremely high potential. The one main drawback would have to be the crashes I experienced. Despite this, I enjoyed using <u>NoteAbility</u> and found it a good package to work with, especially as it was easy to reformat and there are numerous adjustments that can be made to tailor the package to the individual taste quite easily in order to produce professional results. It is not really designed with guitar or numeric lute input in mind, however manipulation of existing features produced a good looking output.* ***Positive*** *elements include the flexibility offered by the package concerning the format and layout of a page, ease of access to information on specific notes, resultant ease of manipulation to these areas, and use of colours and shapes within the package. More negative elements include: the crashes experienced; and the single undo facility.* ***For*** *other users' experiences of <u>NoteAbility</u> please see Appendix 1.*

Practical Acceptability	NoteAbility
Cost	***Retail*** *price:* ***Academic*** *price:* *Upgrades:* ***Multi*** *-licence price:*
Compatibility ʊ With other platforms ʊ With other programmes	<u>***NoteAbility***</u> *is compatible with <u>NoteWriter</u> for Mac, and is available on a Windows platform as well as on OpenStep. It also offers support for Guido, Max Qlist and Max Explode.*
Reliability ʊ Crashing ʊ Suppliers help	***I*** *found that the package crashed quite a lot, specifically when using options such as insert and part extraction.* ***There*** *is only the help feature within the package available, however the suppliers was very helpful when approached.*

2.4.2 Specific Higher Education / Multi-user Results

HE / Multi-user Specific	NoteAbility
Creation, Communication and Dissemination of music Ranges and Quality of Input / Output: u Playback u Visual u Keyboard u Midi / Sequencer u Score Scanning / OMCR u Other Input Methods u All types of music – 'traditional' to 'modern' u Handling of large scores. u Support for collaboration / transfer between other programmes: music and text u Professional result for publications (analytical, research and other)	***Playback*** *options can be accessed either though the* <u>NoteAbility</u> *'Control Panel', the 'Play Score' / 'Play Selection' menus, or the 'Playback Settings' panel in the* <u>NoteAbility</u> *'Inspector'. Basic 'Play', 'Play From', 'Play Staff, 'Pause and 'Tempo' instructions are based in the 'Control Panel'. More specific settings like 'Mute', 'Staff Velocity', 'Create Crescendo / Decrescendo', 'Duration' and 'Accent on Downbeat' instructions can be selected in the 'Inspector' menu. If the area is highlighted and altered using the 'Playback Settings' panel in the 'Inspector' box, dynamic instructions can be set during playback. Tempos can be set for the whole document using the 'Tempo Map'. Articulations like staccato and tenuto, can be represented in a similar manner using the 'Durations' slider. This means that written instructions in the score can be aurally simulated, but are not truly recognised. There is also a 'Playback Map' which indicated the bars to be played for the whole score, in order to simulate recognition of repeat marks.* ***Visual****: The magnification ranges from 25% to 200% in set increments. At 50% and from 87.5% onwards the lines on the stave are evenly spaced, but at times – especially at 25% - it is difficult to input notes accurately as the lines are uneven, the page is too small, and the visuals can look 'blobby'. The 'Insert image' cursor does help with input as it uses a target / cross icon which helps to align input with lines and spaces on the stave. 200% does not produce as massive a magnification as might be expected. The window does not change size to fit when you alter magnification, meaning that you have to manually adjust the size of the window. This tends to interrupt the flow of work, especially when enlarging magnifications. The package switched quite quickly between magnifications, with no graphical remnants. Updating took a second or so. The stave did have spaces at times, where notes had been moved up or down, which took a few seconds to clear, and when moving or altering images on the screen, the score flashed off and on while it updated, and there was a slight delay. There are two fonts available –* <u>Sonata</u> *and* <u>Composer</u> *font. It is extremely easy to switch from one to the other using the preferences panel.* <u>Sonata</u> *font is the default font. It has quite bold note heads and the icons are darker and thicker than the* <u>Composer</u> *font, which can look quite spindly at times – especially the flat signs. When testing the* <u>Composer</u> *font I found that the sharp signs did not align properly: they did not sit correctly on the bass clef – some sat above the top line of the stave. The user creates the page default settings in this package as soon as they open a new document: the 'Document Setup' box, containing information on the format of the score and staves, has to be accepted before you can open a new file. This means that the page – size, systems, staves, barlines, braces, clefs, key signature – can be set immediately. On saying this, the spaces between staves, and the size of the staves and notes were quite large – more suited to a solo piece than ensemble work, however adjustments to these areas are easy to achieve.* ***There*** *are two methods of MIDI keyboard input. One is 'Step-Time' input, wherein the user keys-in the pitches on the MIDI keyboard, and indicates duration through shortcuts or the Control panel at their own speed. The other method is input using the 'MIDI Recorder' located in the 'Tools' menu. This method allows the user to play music into the package and quantize it using the MIDI keyboard and metronome. This method allows for precise indications of tracks, staff ID, stem direction and other MIDI information. This can seem quite intimidating, and there are is wealth of options available, however the default settings can be used to produce good results without having to indicate preferences.* ***MIDI*** *import, export and playback are available. There are precise options for interpretation and preferences for MIDI settings available through the MIDI recorder: Quantization, Track, Staff ID and stem direction; the MIDI set-up for Global Staves; and document preferences panels provide further options for Staff ID, MIDI Channel, Playback, Transposition, Patch Numbers and Pitch Bending.* ***Other*** *input methods include shortcuts, importing of Guido files and QuickScrawl. Another method uses an on-screen 'virtual' keyboard, wherein the pitches of notes are selected by clicking the appropriate note on the keyboard and selecting note duration using keyboard shortcuts. Staff, voice, octave, cursor positioning and preference choices for accidentals can also be selected on the keyboard image. Tuplets, however, do need to be selected using the control panel. This is a useful tool if the user does not have a MIDI keyboard available, and it does not require specialist musical performance talent.* ***NoteAbility*** *caters for more traditional notations. It does offer a reasonably easy lute feature,*

	but this is not numeric, and it is not designed with guitar notation in mind. Although it offers the option to import and to create graphical shapes in the package, it is not really designed to cater for avant-garde notations, where hiding scores might be necessary. Despite this, the package is very flexible and these types of notations can be achieved to a fairly good extent through manipulation of the existing options.
	***Bars**, notes, clefs, key signatures, re-pagination and other changes are handled well by this package concerning an 18-page piece. Generally, insertions are more difficult in a larger piece. Inserting notes can be relatively complicated. When trying to insert a note into the middle of a bar using the regular 'Insert Image' tool, I found that <u>NoteAbility</u> simply inserted it as part of a chord, and did not automatically shift the notes or create new bars. When using the insert option, the package crashed quite a few times, especially if there were not enough bars created to insert the selection into. Part extraction is reasonably flexible. There is an individual part extraction option available from the 'Tools' menu, which allows the layout of the page and the part to be created, formatted and adjusted individually, and to be saved, saved and closed or miniaturised. There is also an option to extract different staves from 'Multiple Documents'. Selection for the staff ID to be extracted is made using a slider scale, thus, extracting staves one and ten does not seem to be directly possible. The option to extract parts using 'Multiple Documents', however, allows the user to duplicate the document and thus overcome this problem. The option to print 2- / 4-up is useful when checking scores, especially if you are working with a big document.*
	<u>NoteAbility</u> allows for saving a file 'To': <u>NoteAbility</u>; Standard MIDI; NeXTScore; Mac <u>NoteWriter</u>; Max Qlist; Max Explode; and Guido. It copies 'Type': <u>NoteAbility</u>; EPS; TIFF; Standard MIDI; NeXT Score; Max Qlist (ASCII); and the option for copying types Csound sco (ASCII) files. It also imports and exports Guido.
	***The** package is page-oriented in design, and offers a wealth of adjustment and fine-tuning facilities regarding all aspects of the notation, layout and formatting which enable a professional and publishable score to be produced. It caters for more traditional notations, with an option for lute tablature and figured bass, however the package can be manipulated to produce good results for other types of notations. The 'Insert image' cursor, and the 'Move entry' cursor are quite difficult to get used to at first, as is manually having to switch from page to page. The default sizes and spacings for the music are quite large, but can be manipulated to produce good results, as the default font used is quite elegant when set to the right proportions. <u>NoteAbility</u> also offers easy collaboration between text processing packages on the NeXTStep platform through the 'Copy Type' EPS / TIFF facility. The crashes were problematic, however, and this package can feel like a 'work in progress'. It does have the potential to overcome these difficulties and become a very good notation package.*
Teaching and Learning Presenting and manipulating in a multi-user learning environment: ᴜ On screen ᴜ Audio ᴜ Tutorials ᴜ Help ᴜ Specific platform advantages for packages that aid teaching	*It is easy to copy a page as a graphic, and therefore to paste a section of music into a text package on the same platform.* ***There** is no set of 'tutorials', so to speak, in the package. There is, however, a good introduction to the package in the help box, which gives a clear guide to the package, its attributes and how to use them. This is well laid out, and is very comprehensible. It covers all aspects of the package accessibly, but is not ideal for a novice computer user.* ***The** 'Help' menu is unusually placed in the 'Info' menu.The help within the package is good, in so far as the 'tutorial' information is good. There is no manual or other online help apart from this.* ***Platform** advantages: NeXTStep advantages for teaching and learning include: being able to print 2- and 4-up; the ability to use Screencast to project your screen onto other computer screens; the use of inspectors; and the easy copy and paste facility between <u>Calliope</u> and text packages on the platform.*
Research and Development Support for: ᴜ Extension and Expansion ᴜ Fine Tuning ᴜ Collaboration and general standards	***There** is no provision for plug-ins available as part of the package. However, there is collaboration with Max Qlist, Max Explode, import and export of Guido and logical music representation language. GUIDO promises to be a popular standard for music encoding and many projects chose already this standard for storing and representing music on the web.* ***There** are a variety of shortcuts available: general and music-specific, and there is the option for one self-created shortcut – the 'Hot button'. There are a lot of one-key shortcuts to be used in conjunction with the mouse, however remembering these can be quite tricky. There is also the availability of 'QuickScrawl', wherein the directional movements of the mouse result in notes and rests. This is quite difficult, but once mastered it could be a useful alternative to inputting music – a sort of musical shorthand.* ***There** is copy and save collaboration for graphical files – EPS and TIFF; MIDI files, Guido, Max Qlist, Max Explode; Mac <u>NoteWriter</u>; and <u>NeXTScore</u> files; and there is also an import and export Guido function.*
Installation, Integration and	*On NeXT and OpenStep Notability can be run as a normal unix application, i.e. within networked installation. This makes upgrading very easy for system administrators. In addition*

Administration	to the ease of installation and upgrading, within a networked environment, all user preferences and user management are handled fantastically, avoiding all clashes known from Windows based systems.
u Ease of installation in network / multi-user and single workplace environments and ease of administration and licensing.	Under Windows, network installation is not known to work.
Other Capabilities	*There is no support for Internet publishing, however there is the option to copy a document as a TIFF file, and the Guido noteserver could be used to dynamically represent scores on the web. GUIDOpromises to become a very good alternative for web publishing, enabling a more dynamic display of music on the web.*

2.4.3 NoteAbility Summary

NoteAbility has the potential to become a very proficient music notation package, however due to the crashing experienced with our version, it does feel like a 'work-in-progress'. It has an extremely wide variety of options that allow the user to tailor the package and adjust practically all aspects of the score individually. Although the menus are organised very logically, the wealth of options can seem very intimidating to a novice user. Also, the need to use specific cursors for input and the restricted undo facility does detract from the ease of use. All-in-all, however, this package is good at the present time, but could be fabulous once these nuances are addressed.

2.5   SCORE

2.5.1 Traditional-Criteria Results for System Acceptability

Score is a DOS-based music notation package. It is designed with professional publishing in mind, and as such it 'emulates traditional plate engraving standards and practices' (Manual: pvii), is page-oriented in design, and all objects are independent of one another: staves, systems and notes. It is completely unique in that the text keyboard is the main method of input, which allows a wealth of fine-tuning. It aims to minimise memory usage by offering a basic on-screen image, where items can be placed at will, however it has extremely powerful capabilities. It consists of five 'modules' which allow input, editing, formatting, printing and the creation and editing of symbols to be included in the score. Other modules can be purchased to augment capabilities as desired.

The package does allow for manipulations that enable avant-garde notations with partially hidden staves, but does not particularly cater for them, although it accepts EPS graphics, complicated tuplets and has a Draw package. MIDI capabilities are not contained within the package, but extra modules can be purchased to cater for this and other functions. Also, MIDI does not work under Window NT, and adjustments have to be made to enable use of the mouse on this platform.

Social Acceptability	Score
Suitability for Specific User Groups ப Specific languages ப Disabled ப Music specialists ப Novices to the package	*The package is English-oriented and offers standard symbols and characters for French, German and other languages.* *As input can be entirely through the text keyboard, this may be of advantage to some disabled users, especially those for whom co-ordination and mouse skills are more difficult.* *The package caters especially well for music publishers, and those looking for high flexibility and wishing to tailor the package to their needs.* *Novice users: The package is quite difficult to get used to as commands are text based, knowledge of DOS is helpful and recommended, and there are various text codes that need to be learned before accurate input can be achieved. It has quite a high learning curve, and can initially be very intimidating for a novice user.*
Advantages / Disadvantages over the 'norm' for a Package of this Type ப Does the package have any special advantage over others of its kind ப Does the package have any disadvantage over others of its kind	*Advantages include: Quick and very accurate text input once the commands are learned. The wealth of fine-tuning capabilities, and numerical input for most items in the score. The Draw module included in the package allows for creation and editing of symbols that can then be imported into Score.* *Disadvantages include: The unusual input method, which is initially difficult to get used to. Text codes and shortcuts which have to be known to produce good results. In 'Input mode' the cursor cannot be used, and all commands are solely text based. MIDI features more advanced than note pitch entry need to be purchased separately. Although it is easy to open more than one file in Score, you can only view one at a time. If you are running Score under DOS, you need to exit Score to run any other program at all, including any of the auxiliary packages (e.g. Draw, Page4, Just4). Under a full Windows 95 / 98 / NT environment, you can switch between Score and other programs, but because Score uses full screen mode, you won't be able to see both at once. Although the screen is nicely uncluttered, the very basic on-screen representation is nowhere near the quality of the final printout.*

Practical Acceptability Usability: Usefulness	Score
Learnability ப How easy / straightforward is it to learn initially ப Direct manipulation / User control vs. computer control ப Numerical values ப WYSIWYG ப Obvious directives and	*The package can initially seem intimidating: especially as input is via text commands – including the start-up of the package. The tutorials are well laid out and easy to follow: the tasks and examples allow the user to get familiar with the commands, but knowledge of DOS is useful. The help facility within the package is good as there is general and context-specific help. Error messages give an indication of what has happened and why, which also help the user to understand how the package operates. The need to use other modules in conjunction with Score can be difficult to get used to at first.* *Direct manipulation is possible insofar as moving and dragging notes in 'Edit mode', however the majority of input and alterations are achieved through text commands and manipulations of parameters.*

results visible u Aesthetic integrity, consistency and reliability – within and between the packages	*manipulations of parameters.* *Numerical values are possible for almost every parameter associated with an item or with formatting.* *Text commands are logical and are immediately represented visually. Error messages normally indicate any actions not completed. As mentioned above, this page-oriented package only offers a basic on-screen representation.* *Text commands link very specifically to the action, and there is direct manipulation of items using the mouse. At times, especially using the zoom or keyboard arrows, it is possible to get disoriented concerning where the image is on screen. The ability to have very specific text commands with parameters allows for direct manipulation of the item, provided the knowledge of parameters is available. However, the fact that parameters change according to the item selected means that they are not always obvious in their use.* *Shortcuts, text commands, menus and function keys are logically organised. Access to all aspects of an item can be seen and edited through the 'Edit' menu and by changing the parameters of items.*
Efficiency u Ease of use: are there extraneous / unnecessary / confusing aspects u Are shortcuts and macros available u Excess number of mouse clicks needed u Templates u Functions which should be automated	*The package is quite straightforward to use, although getting used to the text input method is initially confusing. This could be of great advantage, however, for users with good typing skills. Knowledge of parameters and their complexity can be confusing.* *The use of function-keys and word shortcuts – 'ST' for stave – are the main input methods. Using macros to execute a sequence of actions with one command is strongly advocated in the tutorials.* *Having to quit Score in order to open the other modules connected with it seems time-inefficient.* *There are various templates available within the package for treble, bass, alto, percussion, SATB, piano, organ, string quartet, voice and piano, choir and piano and two types of orchestra templates. These are well spaced out and good-looking, and it is also possible to set up your own templates.* *Layout and formatting of documents and capabilities for handling large scores is not available within the Score package, although they are automated once the particular module – Just4, for example, provided with Score – is opened.*
Memorability u Aesthetic integrity, consistency and reliability – within and between platforms u Knowledge in the Head and Knowledge in the World	*It is necessary to know text commands and shortcuts, parameters and function commands in order to operate the package. As such, the volume of information needed to operate Score can hinder memorability. Also, as the package is text-based, and as such there are no iconic representations of tools. Text commands and shortcuts are logically represented. Typing 'KSIG' relates to inputting a key signature, 'BAR' inserts a barline, and 'LJ' invokes the justification and line-up of the voices in a system. The function menus are also quite logical and straightforward to use, although some abbreviations are not as obvious, and it is necessary to find out what they relate to: 'SHX' in the 'Screen' menu, for example, changes the display of items from the actual type font, to a line-drawing representation.*
Computer Feedback / Error-Handling u How are errors dealt with u Do they explain what is happening u Do they explain why it is happening u Is it always possible to exit / undo u What is the error rate / Do warning messages interfere with or interrupt the flow of input? u Does the package 'forgive'	*An error message normally occurs indicating what has happened / not happened, and why. This allows the user to understand how the package operates. For example, if the number of durations does not match up with the number of pitches and the time signature, then the package highlights that: 'Mismatch. You have typed 6 rhythms. 5 rhythms needed'.* *The undo function is restricted to copy and paste commands, and it is normally possible to exit a menu or abort an action by pressing the ESC key. If not, altering and editing of most items is easily done, and it is also possible to delete / undelete items.* *The package does not provide restrictions and the user is not often presented with an error message.* *The package is not forgiving, although error messages are good, as the undo function is not very advanced, and it is not particularly user-friendly – especially initially.*
Subjective Satisfaction u On first approach u Overall u Specific elements which affected experience u Other user's experiences of the packages – which they use now, and why	*Initially the package is quite intimidating, especially as it is a text-based system, has numerous menus, is not drag-and drop / mouse based, and does not seem very user-friendly. The tutorials give a clear introduction to the package, and the practice gained in them is invaluable. It would be very difficult to operate the package well without having completed the first few tutorials at least. The help within the package, although also DOS-based, is good and links clearly to the operation of the function menus. Text commands and shortcut-help can easily be found in the indexed 'Reference Manual', which also gives tips on using the package.* *Score is a unique package to approach for various reasons: it is text / DOS based, it operates*

	on a module set-up and it uses mainly text and function-key input. This allows minute adjustments to practically all aspects of, and items in, the score, to be made. Once accustomed to the package it can provide a very quick, accurate and efficient input method. As such, <u>Score</u> can produce tailor-made, good-looking professional results.
	***Positive** elements: quick, easy, accurate and efficient input; it can run on very old DOS computers; exact adjustments to items and formatting in the score; and loading of files and programmes is very quick. More negative elements, such as the need to learn commands and use of various modules to format and print scores, does affect prejudicially the positive experience of the package.*
	***For** other users' experiences of <u>Score</u> please see Appendix 1.*

Practical Acceptability	**Score**
Cost	***Retail** Price:* £499 (ex VAT) ***Academic** Price:* £348 (ex VAT) *Upgrades:* *From 3.11 to 4.0* £99 (ex VAT) *From 3xx to 4.0* £155 (ex VAT) *From 1 / 2 to 4.0*** £250 (ex VAT) *From MidiScore* £65 / £29 (ex VAT) depending on the version
Compatibility ᴜ With other platforms ᴜ With other programmes	<u>**Score**</u> *is a DOS programme even when operating on Windows 95 / 98 / NT. And as such, it suffers limitations. It should also run on DOS emulations.*
Reliability ᴜ Crashing ᴜ Suppliers help	***The** package never crashed while I was using it, but it did 'freeze' on two occasions while attempting playback.* ***There** is support from the manuals and package help.*

2.5.2 Specific Higher Education / Multi-user Results

HE / Multi-user Specific	**Score**
Creation, Communication and Dissemination of music Ranges and Quality of Input / Output: ᴜ Playback ᴜ Visual ᴜ Keyboard ᴜ Midi / Sequencer ᴜ Score Scanning / OMCR ᴜ Other Input Methods ᴜ All types of music – 'traditional' to 'modern' ᴜ Handling of large scores. ᴜ Support for collaboration / transfer between other programmes: music and text ᴜ Professional result for publications (analytical, research and other)	***Playback** of up to four staves at a time is available. When using the internal PC speakers only one stave and one note at a time can be played back. There are options to alter individual settings for each stave: MIDI track, channel and patch information. In addition to this, amplitude, transposition and the option to create a 'Playback List', where the order of playback can be input for each stave – 3,2,1 for example indicates that stave 3 is to be played followed by 2, and then 1 – is available. It is important to bear in mind that these settings are for staves, and not for instruments: if an instrument uses two or more staves, then these need to be indicated separately to ensure continuous playback Using the function buttons it is also possible to set and adjust the tempo and playback device – MIDI or PC. The settings for each document can be saved and 'read', allowing for some customisation of settings. The space bar is pressed to begin playback, and playback can be stopped by pressing it again, or by clicking the mouse, or pressing ESC. Solo and muting instruments can be achieved easily using the playback list for staves.* <u>**Score**</u> *is designed with minimisation of memory use in mind in order to make the package faster to use. One of the main ways this is achieved is by using basic looking on-screen graphic images. Notes, staves and other symbols can be represented either using a type of line-drawing, or by their 'actual type fonts' – notes, clefs and beams filled-in. This is only the on-screen representation: the printed image gives a professional output. The magnification is in set values from 0.13 to 16 – 1 being 100%. At the lowest magnification the image is very black and unclear, and it is not until 0.75 that the stave lines are even. From 1.25 magnification, spaces and gaps in the images become more noticeable, especially in noteheads and beams – even when the 'actual type font' is selected – and the images look particularly jaggy. The line shape, which at normal magnifications makes the noteheads seem filled out, disintegrates to a single line at larger percentages. Lines, beams and curves always look bitmapped. From 13 to 16 magnification, the steps seem smaller / not to have as much effect, and there does not seem much difference in magnifications. Redrawing and switching*

between magnifications is quick, and there are no remnants. Accurate input does not depend on the screen or image size as notes are inserted using a text string. Manipulation is normally also achieved by altering these text strings, however it is also possible to adjust the score by clicking and dragging, which can be accurately achieved from 0.75 magnification onwards. There is an additional 'Screen' menu that offers various screen views and offers moving and zooming features: it is here that the 'actual type fonts' option can be selected or deselected. Switching and redrawing here is also very quick and efficient. The zoom feature, however, seems to snap to the end of the top stave, and only if an item is selected will it zoom in to that area of the screen. The default font is Music Symbols. One aspect that can be very confusing at times is that using the arrows to move up and down the screen does not correspond to using a scroll bar. The arrows work in opposite direction to the movement of arrows in any other packages we know, which can lead to the user getting lost and disoriented, and having problems correcting / counteracting the action.

MIDI *keyboard input is possible insofar as the keys on the MIDI keyboard indicating the pitch of notes, and shortcuts / the mouse providing all other information. (We were unable to test this as we were testing on Windows.) Another package – MidiScore – can be bought separately, and linked with the package to allow 'real-time' input via a MIDI or computer keyboard.*

A *separate package – MidiScoreWrite – can be bought separately, and linked with the package to allow translation of MIDI files into Score.*

The *only forms of input are via a text keyboard, mouse or importing other Score files and compatible Coda files such as Page4, Draw, Just4, Scorlas4, MidiScoreWrite and MidiScore.*

Score *caters for various types of music. It caters well for 'traditional' and guitar, and there are noteheads for lute tablature, though this is not especially catered for. It also allows for complex tuplets, the creation and insertion of graphics using the Draw package. The power of use of parameters allows very specific alterations and manipulations that allow for a wide variety of original and avant-garde scores.*

It *is recommended that large scores, with many staves, be split up into smaller files in order to maintain easy and efficient working for both the user and the package. For example, half of an orchestral set-up in one file, and the other half in another: the two files can then be organised and tiled in the Just4 programme – for horizontal and vertical justification of multiple-stave files – included with Score. The files can then be printed using Scorlas4 – also included with Score – which pastes them together. It is also recommended that each file contains one stave, and is named consecutively to enable easy and efficient links with other related files. Additions, deletions and manipulations to large scores are handled well, however the package operates from a page-oriented perspective, and as such each stave is separate and alterations apply only to that stave, which is then justified in the normal way by typing 'LJ'. In order to achieve part extraction, specific information relating to the layout of the parts needs to be saved in a text – 'Part Extractor Control' – file. This lists the name of the first file on the first page, the number of pages in the score and the number of files used to create a page / system (normally saved with consecutive names for easy extraction). This text file is then opened in Page4 – included with Score – to perform page layout and part extraction facilities. In order to extract parts, the user needs to assign every staff in the score with an 'Instrument ID Number' – a value set in P9 of staff attributes – and this identifies the staves to be extracted in Page4.*

Support *for Score and Score text and EPS files, Page4, Draw, Just4, Scorlas4, MidiScore, and MidiScoreWrite.*

Score *is a music publishing, page-oriented package that can produce very professional-looking scores in conjunction with its four other 'modules'. Other modules can be purchased to extend the capacity of the package to include MIDI and other capabilities. The text input method is quite difficult to learn initially, but enables accurate input, minute manipulations of all aspects of the score, and would seem to allow very fast and fluid input via the text keyboard once used to it. It seems to be an outdated approach to have to open, manipulate and save files in other formats – 'filtering' them through other packages like Page4 and Just4 – in order to format, print and extract parts: basic functions of a notation package. Also, the suggestion to save each system in a file seems cumbersome, especially as this means having to manipulate and be in control of all of these files when filtering and combining them into the final score. The package caters well for traditional and guitar music, and there are facilities – noteheads and symbols – for other types of notation.*

Teaching and Learning Presenting and manipulating in a multi-user learning environment: ʊ On screen ʊ Audio	*Score is intended as a professional publishing package. As it can take quite an amount of time to learn all the commands, and as it is DOS in approach, it is, in our opinion, unsuitable for anyone who does not have the time to learn it properly, or for whom there are other packages available which would do the job more efficiently and in a more user-friendly fashion. In a higher education setting there may be a number of users who would fit into the latter category. Equally, the are others for whom investing the time in Score could allow access to a*

u Tutorials u Help u Specific platform advantages for packages that aid teaching	*vast and powerful range of unfettered capabilities.* ***The*** *tutorials are located in the 'Users Guide', and give a clear introduction to the package. There is good use of visuals and tasks are given, followed by completed examples of how the task should have been fulfilled: helping the user to understand the package and the text instructions easily. Also, there is good use of error messages, which also give the user a fuller picture of the package. One such error message is: 'Mismatch. You typed 6 rhythms, 7 rhythms needed.'* ***Help*** *is located in various forms. There is the 'Reference Manual', which indexes and gives details and tips on package features, and there are the help facilities within the package – general F1 help and context specific help related to the function keys in the specific menu being worked on.* ***DOS*** *advantages: The capability to run on very old and basic hardware with small memory and hard disk capacity.*	
Research and Development Support for: u Extension and Expansion u Fine Tuning u Collaboration and general standards	***The*** *complete* <u>*Score*</u> *package comprises of five modules, and there is the option to purchase extra modules to include MIDI and other capabilities.* ***There*** *are numerous function-key and text shortcuts, and the package advocates the use of macros – which are easily constructed.* ***Collaboration*** *is available with the various modules advocated for use with* <u>*Score*</u>*, and with text and EPS files created within the package.*	
Installation, Integration and Administration u Ease of installation in network / multi-user and single workplace environments and ease of administration and licensing	*The installation is easy providing experience with DOS is existent.* *There is no possibility for network installation, or multiuser support.*	
Other Capabilities	***No*** *Internet publishing support is available.*	

2.5.3 Score Summary

<u>Score</u> is another package that comes from the engraver and publisher's standpoint. It operates through text input, which seems a very unmusical way to input music, in today's 'drop and drag' age. This, however, is quite a positive attribute insofar as every item on the score can be manipulated in minute detail. It is not as positive, though, as numerous text and other commands have to be learned and memorised: which is especially hard initially. <u>Score</u> itself is a basic input and editing package, which works with four other modules to offer a wider range of formatting, drawing and printing capabilities, and there are other modules that can be purchased separately which allow for the addition of MIDI features. One advantage of operating within this framework is that memory space is kept to a minimum, and as a result the package can operate on very old computers, however this also translates into basic on-screen images. <u>Score</u> can cater for a wide variety of music, and offers very powerful features for those who take the time to learn its capabilities.

2.6 SIBELIUS VERSION 1.22 FOR WINDOWS ON PC

2.6.1 Traditional-Criteria Results for System Acceptability

Sibelius is, according to the manual: ' the state-of-the-art scorewriter – a fast, intelligent, easy-to-learn and (not least) fun-to-use professional program which helps you write, play back and print music'. It is: 'like having an intelligent assistant at your side, doing all the tedious work for you while you provide the creative input' (Manual, Quick Tour: p20).

As such, Sibelius is more intuitive than some of the other packages: it comes more from a 'creative' rather than publishing / page specific viewpoint. This means that it is designed to be user-friendly and cater for a wide variety of needs, with numerous plug-ins to adapt and tailor the package as wanted. Although Sibelius is designed to cater for composition it does have a good publishing aspect, wherein format and layout of a page can be manipulated and changed quite easily, but individual manipulations of items – stem lengths for example – are not as well provided for.

It caters well for most types of music: traditional, avant-garde, guitar, but is not especially proficient concerning older notations. Sibelius is not really intended for older notations, although there is a lute / multi-stringed / multi-tuning facility linked to the guitar TAB, and there are also various types of note heads available. It is not really designed to operate on publishing terms, although it is page-oriented in design and the page format and layout can be easily manipulated

Social Acceptability	Sibelius
Suitability for Specific User Groups ப Specific languages ப Disabled ப Music specialists ப Novices to the package	***There*** *is 'a localized version in German and a version which ships with an Italian manual but the program itself is still in English' and there is 'a Dutch manual in progress' (Sibelius UK Marketing and Sales Manager), in addition to the American-English version available. There are standard text font, character encodings and symbols available for French, German and other languages.* ***There*** *are numerous types of input, shortcuts and screen manipulations – one-key shortcuts, good zoom and magnification qualities, however there are no specific in-built facilities for a disabled user.* ***The*** *package caters for a wide variety of users, and offers plug-ins for checking music rules (parallel fifths and octaves). Although the layout of scores is quite flexible and it offers options for older notations, they are not especially catered for. There is also a ManuScript language allowing users to develop and expand the capabilities of the package.* ***The*** *package is particularly accessible to all types of users, including very beginners. It has a very low learning curve: users can access the package easily with very little musical knowledge and experience, and seem able / more confident to perform quite complex tasks relatively quickly.*
Advantages / Disadvantages over the 'norm' for a Package of this Type ப Does the package have any special advantage over others of its kind ப Does the package have any disadvantage over others of its kind	***Sibelius*** *is accessible for novice users and allows for avant-garde notation and flexibility in scores. If you have written out of the range of an instrument the notes are highlighted in red. The variety of plug-ins – especially the scanner and web page options, the range and type of shortcuts, and the programming capabilities (using the ManuScript language), are all useful features in the package.* ***The*** *package does not really cater for older notations, and there can be unwanted computer intervention when trying to perform certain tasks, especially when the action does not conform to the musical intelligence of the package: inputting too many notes into a bar, for example, results in a warning message that 'This will not fit in this bar'.*

Practical Acceptability Usability: Usefulness	Sibelius
Learnability ப How easy / straightforward is it to learn initially ப Direct manipulation /	***The*** *tutorials are very well structured and are easy to follow and there is a quick reference card that is helpful insofar as it lists, textually, shortcuts. They cater for the very beginner, up to the professional user. The package help is good, as is the reference and index section of the manual, although it is important to remember that these use American spellings. The screen and tools are very user-friendly, and the multi-undo facility helps to build the confidence of a*

User control vs. computer control ᴜ Numerical values ᴜ WYSIWYG ᴜ Obvious directives and results visible ᴜ Aesthetic integrity, consistency and reliability – within and between the packages	*new user as any mistakes can be easily undone.* ***The*** *user is in control of most objects on the screen as everything can be manipulated by clicking and dragging with the mouse, editing items using the menus or the keypad, or by representing the item as a symbol, and manipulating them as such. There are forced actions, however if they do occur they can usually be overridden using the menus: for example, one way to override the message 'This note is too big to fit into this bar' is to change the key signature, and hide it if necessary, for that bar.* ***Numerical*** *values are mainly available for page layout and formatting, modifying existing elements like symbols, and for measuring or counting bars. It is possible to alter the default positionings for notes and symbols numerically via the house style, however it is not possible to alter these numerically individually. The alternatives to this are moving items by eye using the mouse, arrows for moving values up and down, or radio buttons / check boxes.* ***Sibelius*** *goes to great lengths to be WYSIWYG – even down to allowing a variety of 'paper type' backgrounds in documents. It operates from a page-oriented screen layout, and as such any manipulations or changes can be seen to happen on the screen, and are reflected in the printout.* ***Changes*** *and alterations usually result in the expected outcome on screen. If not, the package normally gives feedback indicating that the action has not been possible. Generally, this only happens when the expectations of the musical intelligence of the package are not conformed to, for example: 'This note is too big to fit into this bar'. Also, the mouse control allows for instant feedback on manipulations, as almost everything can be 'clicked and dragged'.* ***Standard*** *platform shortcuts and 'General' shortcuts, are available, and the logical organisation of the one-key shortcuts – pitches by note name for example – help learnability. Also, anything that cannot be notated using the text keyboard or keypad is located in the main menus, which are very logically arranged. For example, the 'Create' menu adds new items to the score; the 'Notes' menu alters voicings, spellings, noteheads, beams, and the 'Layout' menu defines formatting and set-up of documents and pages. In addition to this, the options boxes are also clearly laid out. All of these help to maintain integrity and memorability within the packages.*
Efficiency ᴜ Ease of use: are there extraneous / unnecessary / confusing aspects ᴜ Are shortcuts and macros available ᴜ Excess use of mouse clicks needed ᴜ Templates ᴜ Functions which should be automated	***It*** *can be difficult to get all of the information pertaining to one item as there are no Inspector features on this platform. Some numerical alterations are only applicable as house styles, and not possible individually for some items – which has implications for publishing-specific use. Although the multiple undo facility is good, it can sometimes be difficult to identify what you want to undo as it takes account of all actions: including highlighting, de-selecting, and dragging notes. This means that it can take several clicks to undo the insertion of a note, or that it can be difficult to find the correct place in the 'Undo History' box.* ***There*** *are a wide variety of shortcuts available: general, music-specific and self-created, and there are also one-key shortcuts available. It is possible to alter the existing shortcuts and pre-set functions, but it is not possible to create new ones.* ***The*** *'Create / Add Instrument' box can be confusing as it is necessary to select the instrument family, 'Add' the instrument, and then select 'Create' for the document to be created. Creation of text can be quite complex, as there are numerous types and styles available, and although the undo facility is advanced, it can lead to numerous clicks of undo to achieve the desired result.* ***There*** *are a wide variety of good-looking default settings available for a variety of ensembles. For example, there are: wind quintet; big band; jazz quartet; full orchestra; film orchestra; Inkpen A4; guitar and TAB; and brass band templates.*
Memorability ᴜ Aesthetic integrity, consistency and reliability – within and between platforms ᴜ Knowledge in the Head and Knowledge in the World	***Standard*** *platform shortcuts and locations for editing the score are available. Most items can be manipulated using the mouse or numeric keypad, however menus are available for specific editing tasks, and for making more global changes, such as page layout / format. Menus are clearly laid out, normally requiring something to be highlighted or selected before pressing OK. There are links attaching text and other items to a note / part of the stave / barline. This means that locating which item an object is attached to can sometimes be difficult, as can selecting and isolating one attachment when there are several in that area. These links can be adjusted to attach to other items in the score very easily.* ***Icons*** *are well represented and clearly link to their function.*
Computer Feedback / Error-Handling ᴜ How are errors dealt with ᴜ Do they explain what is happening ᴜ Do they explain why it is happening	***Error*** *messages normally occur when the artificial intelligence of the package is not conformed to, or to check whether the user really wants to proceed with an unusual request: for example, trying to put a semi-breve in a full bar will result in this warning message 'This is note is too big to fit into this bar'. Sometimes, however, the artificial intelligence of the package allows the user to choose whether to continue with an action. For example: 'Deleting a rest leaves a gap in the bar which has the same effect as a rest. This is normally needed for special notations. Do you want to go ahead?'*

ᴜ Is it always possible to exit / undo ᴜ What is the error rate / Do warning messages interfere with or interrupt the flow of input? ᴜ Does the package 'forgive'	*There* is a multiple undo / redo function available, so it is generally always possible to exit or undo an action. *Sibelius* provides a higher level of interaction with users than some of the other packages. The package is flexible, although sometimes does not allow the user to continue with an action depending on its defaults and whether these can be altered. *I* would say that the package is forgiving due to the multiple undo facility and the user-friendliness of the package.
Subjective Satisfaction ᴜ On first approach ᴜ Overall ᴜ Specific elements which affected experience ᴜ Other user's experiences of the packages – which they use now, and why	*I* found the package quite easy to access initially. It has a user-friendly interface, and the manual and tutorials are very readable. The help facility is good, and it is logically organised and straightforward to use. *Overall* I feel that the package produces good results with quite little effort. It is accessible to all users, even those wanting to create their own plug-ins and tailor the package to their specifications, and it is very flexible. It can produce professional looking scores for a wide variety of music, and the web and scanning plug-ins are of increasing value for both commercial and non-commercial use. *Positive* elements include the: variety of plug-ins, especially the scanning and web facility; the multiple-undo / redo facility; the flexibility of the package; the wide range of templates offered; and the accessibility for all types of users. More negative elements include a higher level of computer interaction, the inability to manipulate items individually as would be needed for publishing conventions, and that there is no one place to access all of the information concerning an object / no inspector. *For* other users' experiences of *Sibelius* please see Appendix 1

Practical Acceptability	**Sibelius**
Cost	*Advertised* on the *Sibelius* website for £595 (plus £4 delivery) including VAT for both Mac and Windows versions (June 2000). *Academic* multi-licence price structure (excluding VAT) is as follows: *1 copy* £339 *5-user site licence* £678 *10-user site licence* £1149 *15-user site licence* £1599 *20-user site licence* £1999 *30-user site licence* £2670 *40-user site licence* £3160 *There* is also the option to trade-up by paying the difference in price between licences (*Sibelius* UK Marketing and Sales Manager).
Compatibility ᴜ With other platforms ᴜ With other programmes	*Sibelius* is available for both Mac and PC. *It* offers support for scanned music as well as *Sibelius* scores.
Reliability ᴜ Crashing ᴜ Suppliers help	*The* package never crashed while I was using it. *The* package help is very good, as is the email response from the suppliers. The manual is clearly presented with easy to follow instructions and explanations.

2.6.2 Specific Higher Education / Multi-user Results

HE / Multi-user Specific	Sibelius
Creation, Communication and Dissemination of music Ranges and Quality of Input / Output: ᴜ Playback ᴜ Visual ᴜ Keyboard ᴜ Midi / Sequencer ᴜ Score Scanning / OMCR ᴜ Other Input Methods ᴜ All types of music – 'traditional' to 'modern' ᴜ Handling of large scores. ᴜ Support for collaboration / transfer between other programmes: music and text ᴜ Professional result for publications (analytical, research and other)	*Playback: Sibelius has very strong playback features that can be accessed, changed and manipulated easily. For example: 'Sounds' (which instrument); mute, half-mute (for soloing and reducing the volume to half output) – this can also be achieved by highlighting one stave / part of stave and pressing play, solo and tutti; 'Balance' (volume between instruments); 'Pan' (affecting spacialisation – allowing sounds to come from left, right or centre, and thereby allowing for orchestral audio set-up of instruments); 'Distance' (simulating a certain distance from listener and affecting reverb); 'Bank', 'Program' and 'Channel' (MIDI settings). In addition to these features, there is also an 'Espressivo' feature wherein tempos, dynamics, articulations and other performance markings in the score are recognised and interpreted by Sibelius during playback. Allowance for variations in swing, reverb and 'Expressivo' are also catered for, however using 'notes inegales' and 'dotted eighths' in the swing menu (for a string quartet set-up) meant that certain notes 'hung' until the end of the piece, confusing the sounds during playback. Linked to the 'Expressivo' feature, there is a dictionary in which the parameters for the interpretation of terms such as forte and pizzicato can be set, and there is the additional option to add your own terms and parameters. Also, when repeats, transpositions, and other changes are made in the score, the playback adapts and follows them. The range of instruments available is very wide. In addition there is also an 'Options' dialog box relating to metronome clicks, notes being sounded when input. Ultimately, however, the sound quality is going to be decided by the quality of the soundcard.* *Magnification ranges from 12.5% to 1600% in set increments. Each step seems to be set so that the lines on the stave are as evenly spaced and clean looking as possible at that magnification. Input can be added accurately from 75% onwards. From 100% onwards it becomes necessary to drag the section of page you want to work on into view: sometimes – especially if you use a high magnification – which can be disorienting, and it is necessary to click on the 'navigator' map to the left of the screen. This navigator is quite a useful tool, as is the numerical keypad representation – initially located at the bottom right of the window – when moving, changing and inputting notes. Other viewing options are also available: 'fit page / 2 pages', 'width' and 'actual size'. The standard font available is Opus – quite an elegant and modern-looking font, and there is also Inkpen font available, which is advertised in the manual as simulating a 'neatly hand-written' score suitable for jazz music. The main differences with this font are that it is darker, 'blobbier' heads and thicker clefs, rests. Sibelius switches between magnifications very quickly and cleanly – no graphical remnants – and switching between views is also quite quick. On a slower computer, however, moving and redrawing can result in jumps. Sometimes the default spacing between systems can seem quite large, but this is dependent on the number of systems per page and whether they can fit the page. As this number increases, the formatting becomes better. The document aligns to the head margin on each page, which can look strange if the first page only contains two systems. All of these options can be changed by dragging, or by using layout, formatting, and other settings. It should also be noted that the default does not use scroll bars in this package: movement around the screen / page is operated by a navigator map, but scroll bars can be activated if required.* *The MIDI keyboard input is available through two different methods: 'Step-time' and 'Flexi-time' input. 'Step-time' entry involves using one hand for the keyboard (indicating pitches), and the other for numeric keypad / shortcuts (giving durations and articulations). The co-ordination needed for this is quite tricky at first, but it is a very straightforward method, which could be easily mastered with practice. This method enables quick, easy and very accurate input at the users' own speed, and the usual problem of quantization is avoided. There is a similar method which uses the mouse for pitches, and the keypad for durations. In 'Flexi-time' input you play the keyboard, with or without the metronome, and Sibelius records and interprets this into the score. There is the additional facility here that when you speed up / slow down your playing, 'Flexi-time' will follow you. Both of these methods are easy to use and produce fairly accurate scores: there is an options-box allowing you to set whether tuplets, articulations are interpreted, and there is always the option of using keyboard shortcuts as you play, or once finished, for corrections.* *Import, Export and MIDI playback are all available. When MIDI scores are imported a new document is opened, and there are various preferences you can choose from: Manuscript paper – orchestra and string quartet set-up; Sounds in the MIDI file; Equipment for playback; Notate metronome marks, MIDI messages, one staff per track, instrument order, track order; Rhythm options – tuplets, articulation and minimum note value. Interpretation was quite accurate, but depended on the options chosen for the set-up of the document. These both depended on the selections made for the interpretation of the MIDI file. Direct playback*

of these MIDI files was good.

Sibelius comes equipped with an in-built scanning package plug-in – Neuratron's PhotoScore Lite. This is a reduced version of the full package PhotoScore, which is available separately through Sibelius. It is possible to scan up to twelve staves in PhotScore Lite, and once scanned, the image is retained and saved to a list allowing for multiple scanning before ordering and editing the pages. Ties, slurs and hairpins are all recognised, but articulations, text, dynamics, lyrics and other features are only available in the full version. There is quite a wide variety of scales with which to scan available: both for black and white and for colour. The package also allows for calculating and adjusting the image if it is at a slant, in order for the music to be straight on the screen, as well as trying to locate and calibrate the staves automatically, but this can also be done manually, as they have to be highlighted in order for the music scanning and interpretation to be accurate. When scanned, the image is transferred to an editing screen, to compare with the original image, and to perform editing adjustments. Again, only certain facilities are available in the Lite version: reduced keypad operations and basic options from the Sibelius 'Create' menu – key signature, time signature, bar rest, barline and clef. As staves are treated as individual during the scanning process, arpeggios and runs which cross staves cannot be linked up, leading to mis-interpretation in Sibelius. It can also be difficult to create chords, join beams, remove flats or sharps completely without deleting the note and re-writing it, and there is no undo facility. This edited scanned image is quite easily transferred to Sibelius, where other editing, formatting and saving operations can be carried out. Clefs, time signatures and key signatures are all recognised automatically. The music is automatically moved to the right if there are any spaces with no rests left on the editing screen, and as each stave is separate, it was not possible to properly notate linked notes which crossed between staves – which meant that this had to be re-adjusted in Sibelius. Scanning and editing one page (without editing in Sibelius) took around 20 to 30 minutes, which is quite a long time if a large score is to be input, however the results were quite accurate and if the piece was relatively simple, then scanning could be done to a fairly high standard using PhotScore Lite.

Other inputs include shortcuts, using numeric, alphabetic and CTR plus 'x' methods, and importing MIDI, bitmapped graphics, and other Sibelius files.

Sibelius caters for all types of music: traditional, guitar and avant-garde scores with graphics and partially hidden staves. There is also an option for lute tablature, and noteheads for various other types of notation are available. It was extremely flexible concerning the twentieth-century score produced, and allows good adaptability for other types of music.

The package copes very efficiently with input and manipulation of large scores using a MIDI file. Accepts and repaginates changes and additions in clefs, notes, key signatures, time signature very easily. The part extraction feature opens each part into a new document, organises and collates multiple rests and offers to save them to a folder, transpose, reset spacings. Part extraction appears to be for consecutive parts, therefore you can extract parts one and two, but not one and three, however it is possible to 'CTRL-click' to highlight one and three, and extract 'All selected staves'. It is possible to define whether each part contains one staff, one instrument, or all selected instruments. There are editing and formatting options available that allow for following or ignoring current breaks, note spacing, transposition, instrument names, and for adjusting the format of the new page.

Allowances for saving as a: Sibelius file; MIDI file; 'scorch web page'; and as a graphic – EMF or BMP file to be used in text processors and other packages. There are also options for importing: Sibelius; MIDI; scanned music (.opt); graphics (.bmp); and (.sif) files, and for importing and exporting 'Style' files.

Sibelius produces a highly publishable score. House-style options allow for fine-tuning of the layout and preferences in each document and the set styles for ensembles and Inkpen manuscripts save time when initially formatting a piece. There is not, however, the option to individually position articulations, although it is possible to change the global options using the House Style preferences This could be problematic for professional typesetters. It is also not possible to format pages individually unless each is in a separate document, or you manually click and drag items to line up staves and systems on pages two and three, for example, by eye – which could similarly be problematic for music typesetters. It can also be problematic to get the properties of an item by right-clicking, as selection has to be very precise. There is a need to be careful when printing, as there are so many paper size options that your printer option and the document option need to match, or the file will not printout. Import and export of various types of file formats makes it a flexible package, as does the variety and ease of input options. Both the Web feature and the scanning option increase the flexibility and attractiveness of the package for a wide range of users.

Teaching and Learning	*There is a very good magnification / zoom feature, and the option to 'add note names' to a piece via a plug-in could be very useful in a teaching environment. Particularly good features for a teaching and learning environment are the music-specific technical helps found in the plug-ins section. In addition to 'add note names' there is: check pizzicato (for cancellation);*
Presenting and manipulating in a multi-user learning environment:	

u On screen u Audio u Tutorials u Help u Specific platform advantages for packages that aid teaching		*check repeat marks; check clefs / check for suspect clefs; find range; calculate tessitura; and check for parallel 5ths and 8ves.* **The** *variety of input options through keyboard, especially the 'Flexi-time' input, could be very useful, and there is a very large range of instruments available.* **The** *'Quick Tour' tutorials in the manual cater for the very beginner through to an expert user. They were clear and provided a step-by-step introduction to the package. Their links to already-created <u>Sibelius</u> files are helpful and interesting. I found the tutorials to be quite patronising at times, however, especially concerning the US versus UK language used within the manual: 'Any British readers who are offended by the American spelling of "center", "color" in the User Guide and program will just have to use a pen to amend the spelling in the User Guide or (less effectively) on the screen' (p18). This is not a reflection of the quality of the tutorials and manual, however, as explanations are very clearly laid out.* **The** *help facility is quite good within the package, although there are a lot of references back to the manual for more information. The layout of the manual – in a reference and index form – is quite helpful, and the reference section is very useful, and readable even on its own. Sometimes it can be difficult to find entries as they are under American spellings, but there are a lot of cross-references which help to locate information, and the index section is not too long to go through (18 sides A5).* **Platform** *advantages: Windows advantages for teaching and learning include the wide variety of multimedia peripheral devices and MIDI and audio soundcards available. There is also the option to use VNC – the Windows version of Screencast.*
Research and Development Support for: u Extension and Expansion u Fine Tuning u Collaboration and general standards		**Modularity**, *a variety of plug-ins, the option to develop and edit your own or existing plug-ins, and programming capabilities through <u>Sibelius</u>' own programming language, <u>ManuScript,</u> are all available.* **General**, *music-specific and self-created shortcuts are all available. There are also one-key shortcuts available for common actions such as single letters for note names, which allow the user to create input solely through the text keyboard, and there is also the option to edit existing plug-ins in the plug-in menu.* **There** *is support for <u>Sibelius</u> files – Mac and PC, EMF, BMP, MIDI, scanned music files and for the creation of music web files.*
Installation, Integration and Administration u Ease of installation in network / multi-user and single workplace environments and ease of administration and licensing.		*Sibelius is easy to install and since a year network licenses are available. This feature, although good for educational institutions to be provided by reduced licenses, still has some bugs. For instance, for Sibelius applications to run within a network installation, there always have to be two Sibelius applications open on the network. This implies that for institutions with larger and distributed numbers of computers, one machine will always need to be used as a "dedicated Sibelius server", never turning Sibelius off (or never exiting Sibelius), in order for Sibelius to be available in the case only one other person wants to use it.* *The installation also has still some weaknesses in its design in that it writes to system files, which make the installation in intranets running network software, such as Novell Networks, extremely tedious to set up. (System files not being accessible in most multi-user networked set-ups). This makes installation a process of reprogramming where user preferences are being kept or readjusting the network software for write access to specific files.*
Other Capabilities		**There** *is a facility for creating music web pages available: there is an option in the 'Save As' menu to save a <u>Sibelius</u> score as a Scorch web page. This means that you can link to, or include, this score as part of your own website. Even if <u>Sibelius</u> is not loaded onto the machine where playback is to take place, there is a free plug-in which can be downloaded from the <u>Sibelius</u> website to view and hear the score – links are automatically given when the user tries to view the score. The score can be played back from the browser, rewound, fast-forwarded, paused and transposed. The score itself can be scaled and resized, but there is a tendency for it to stretch out of shape. When decreasing the size of the score, the buttons for playback remain the same size, which can look odd in comparison to the scale of the score. There are arrows to view previous / next pages, and the playback automatically turns pages, even if slightly delayed. A score with one bar is represented exactly as it is in the document: therefore to adjust it to a reasonable width, it is necessary to alter the margins in the original <u>Sibelius</u> document to provide a good-looking score.*

2.6.3 Sibelius Summary

<u>Sibelius,</u> in contrast to some of the other packages, operates more from a compositional stance than a publishing one – although the view is that of a page representation – and it does not allow the wealth of publishing-oriented fine tuning that some of the other packages do. It does offer a wide variety of shortcut and plug-in capabilities, and has especially strong in-built playback, scanning and Internet

features, all of which are reflected in the price. It is a very easily accessible and user-friendly package, which caters well for beginners, and also offers a wide variety of well thought out features which mean that it is attractive to the majority of people looking for a notation package.

SECTION THREE

Smaller packages, including open source software and shareware, often answer already the need and the requirements by certain users, and are thus included in this evaluation. The number of them call for a shorter evaluation of these. Some of these packages are of extremely good quality, some of them only achieve this quality with a heavy amount of user input. Others are very simple packages which might be just what somebody needs to create smaller examples for one's publication.

In the first part of this section (Section 3.1) we will give a brief overview of 12 smaller packages, mentioning briefly their history and purpose and operating procedures / features, and also giving examples of the packages and their prices. For this section we have used two base sites from which to gather information:
http://www.sline.de/homepages/gerd_castan/compmus/notationformats_e.html#TexTab and
http://ace.acadiau.ca/score/others.htm ; and we have also used the various websites and references mentioned for each package. One main book used as a source of information was: *Beyond MIDI: The Handbook of Musical Codes* edited by Eleanor Selfridge-Field (©1997 Centre for Computer Assisted Research in the Humanities – Massachusetts and London: MIT Press).

In the second half of this section (Section 3.2) we provide an introduction to some of the music and file format standards and terms mentioned in the evaluation, and in the latter part of this section (Section 3.3) we give an indication of scanners and other software options.

As mentioned above, the advantages to use smaller packages can be very strong:
- price: some of these packages are free, others ask for minute amounts, again others may just ask for a postcard to be send to the author
- ease of installation: simple packages are simpler to install
- availability of the software online at any time: for users needing a package right there and then (with a deadline looming tomorrow, for instance) shareware packages are the saviour
- ease of learning: simpler packages are often simpler to learn
- existence of a large user community: community based developments have a very attractive large user community, allowing for highly professional support from help to big fixes to changes in the program, and all without the heavy costs involved with larger applications
- availability of the source code: the availability of source code makes it extremely interesting for academic researchers, who will always be in need of integrating existing applications inot other applications or integrating solutions into existing applications
- belief in user based developmental efforts, such as open source: it has become somewhat of a political and ethical choice for many to go for open source, instead of supporting proprietary, possibly monopolistic, and sometimes user-distant commercial packages.

But to be fair, one has to look at the disadvantages as well. These can range from:
- poor reliability: if unsupported the software may be buggy or may not work under every condition and every hardware and software constellation. (But of course this is the same for all other packages as well)
- quite often smaller packages concentrate on a specific strengths, and are often not as multifunctional as professional packages
- support might not be always available and not always be professional
- the output quality is often not as of high standard than in professional packages
- the package may be stopped in its development
- the storage format might not be supported by other packages or may be stopped to be supported at all
- you might have to write a postcard.

3.1   SMALLER PACKAGES

3.1.1. Lilypond – The GNU Project Music Typesetter

http://www.cs.uu.nl/people/hanwen/lilypond/index.html

History / Purpose

Lilypond is a music typesetter inspired by engraved music. This means that input for the programme is by plain text, rather than by musical representation, similar to conventional text typesetters where input for formatting and page representation is encoded rather than using a WYSIWYG input. Lilypond produces high quality sheet music using a high-level description file as input. It excels at typesetting classical music, but also caters for print pop-songs.

The approach of the two main creators to 'this complicated problem, typesetting music with a computer' is that:

> *'Lilypond tries to typeset music *automatically*. We (…) try to put as much of our knowledge of music typography into the program as possible, and have as little typographical information in the input as possible. Basically, you ought to be able to produce nicely printed scores with Lilypond without nowing anything about engraving.'[1]*

Lilypond is free software and is part of the GNU Project, licensed under GNU General Public License.[2] So users can use, modify and redistribute the program with almost no restrictions. As one of the main creators, Han-Wen Nienhuys, indicates:

> *'[Free] Not only in the sense that you can download Lilypond at no charge, but it is also free as in "free speech". Users are free to modify the program to suit their needs, and redistribute or sell the program. Moreover, since the program can be downloaded at no cost, I don't gain anything if it gets more users.'[3]*

Linked to the fact that the package is 'free' in all senses, it was not designed for a specific market – simply for anyone who may wish to use it. Improvements have been integrated from a wider user/developer community and made the software a result of a collaborative activity with high quality output and high usefulness.

The package is under constant construction, and updates are frequent. This is the intention of the creators of the Lilypond, who recognise that it is still a work in progress and that there is always room for improvements.[4] This means that the package expands and develops as it is used: in reaction to the needs and wants of the user community.

Operating Procedure / Features

The operating system (OS) available is LINUX (Red Hat and Debian) and Windows NT. As has been mentioned above, the input to Lilypond is plain text / ASCII. Any text editor can be used to create that text.

This means that there is no mouse input, and in a certain sense it is an 'unmusical' way to input music – there are no conventional visual music representations. Another aspect of this is that it is not designed with midi or playback in mind, however there is a midi to Lilypond converter available, and midi can be

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[1] From a posting in rec.music.classical.guitar, Han-Wen Nienhuys, April 11, 1999,
http://www.cs.uu.nl/people/hanwen/lilypond/Documentation/misc/out-www/AIMS.txt
[2] GNU (GNU's Not Unix) is an open source code initiative, as described in the words of Richard Stallman: 'We did not call our software "free software", because that term did not yet exist; but that is what it was.'
(http://www.gnu.org/gnu/thegnuproject.html)
[3] http://www.cs.uu.nl/people/hanwen/lilypond/Documentation/misc/out-www/AIMS.txt [From a posting in rec.music.classical.guitar] Han-Wen Nienhuys, April 11, 1999
[4] Ibid.

imported into Lilypond, but not exported. Editing graphically is not available, however the output given is more complex than in other packages which do offer such a feature, ABC2MteX for example.

One of the main advantages of using a plain text input is that files can be easily transmitted through email, the Internet and through various text processors, allowing a free flow of communication. There is a growing community of people who are using Lilypond to communicate over the Internet.

Example
Here is an example of the input and output of Lilypond.

```
\relative c'' { \key c \minor; r8 c16 b c8 g as c16 b c8 d | g,4 }
```

Examples taken from http://www.cs.uu.nl/people/hanwen/lilypond/index.html.
For a more complex examples, see Appendix.

Creators
The two main creators of Lilypond are:
Han-Wen Nienhuys, (http://www.cs.uu.nl/~hanwen/ Main author) and
Jan Nieuwenhuizen, (http://www.xs4all.nl/~jantien/ Main author).
Other contributors to the package mentioned in the website include:
Tom Cato Amundsen, Mats Bengtsson, Eric Bullinger, Laura Conrad, Jan Arne Fagertun, Anthony Fok, Bjoern Jacke, Neil Jerram, Donald Ervin Knuth, Michael Krause, Dirk Lattermann, Werner Lemberg, David R. Linn, Adrian Mariano, Christian Mondrup, Alexandre Oliva, Francois Pinard, Stephen Peters, Glen Prideaux, Roy R. Rankin, Jeffrey B. Reed, Shay Rojanski and August S.Sigov.

Price: £ 0 - Free

3.1.2. abc family

http://www.gre.ac.uk/~c.walshaw/abc/

History / Purpose
Like Lilypond, ABC is a language designed to notate tunes in a text/ASCII format. Designed primarily for folk and traditional tunes of Western European origin (such as English, Irish and Scottish) it primarily catered and still caters for music which can be written on one stave in standard classical notation. But through the past years of development many extensions have been added in order to be able to notate other types of music.

The development of abc began at the end of 1991 it has become very popular. Many PC and UNIX based tools exist which are able to read abc notation and either process it into staff notation or play it.

> *'One of the most important aims of abc notation, and perhaps one that distinguishes it from most, if not all, computer-readable musical languages is that it can be easily read (…) In other words, with a little practice, it is possible to play a tune directly from the abc notation without having to process and print it out. Even if this isn't of interest, the resulting clarity of the notation makes it fairly easy to notate tunes. In addition, the ability to write music in abc notation means that it can be easily and portably stored or transported electronically hence enabling the discussion and dissemination of music via email.'[5]*

the fact that it is ASCII based means that it can be transmitted easily by email and the Internet. This also means that it can be written using various text processors and by hand anywhere at anytime. Devised by Chris Walshaw, abc is widely used for the notating and distribution of tunes, particularly on the internet and has become very popular in traditional music circles. It is also gaining in popularity in early music.

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[5] Chris Walshaw, http://www.gre.ac.uk/~c.walshaw/abc/

There are many tools to convert abc notation into printable or viewable sheet music, most of them convert abc into postscript. Amongst these tools most of the standard operating systems are covered.

abc2mtex is the orginial package which converts abc notation into printable sheet music. These converters are available for pc, mac and unix, although the whole tex and MusicTex (see below) packages need to be installed as well. abc2ps for Mac also converts abc into postscript, but without the need to preinstall tex and MusicTex. abcm2ps does the same but for Win95.

Other packages cater for the need to input music in a graphical manner, playing tunes through midi, or displaying editing or viewing scores on the web through java applets.

Operating Procedure / Features
Abc notation is a simple but powerful ASCII musical notation format. One example of abc input is:

```
X:1
T:Beams
M:C
K:C
A B c d AB cd|ABcd ABc2|]
```


Examples taken from http://www.gre.ac.uk/~c.walshaw/abc/.
For a more complex examples, see Appendix.

A tune notated in abc can be played directly from the notation, or many software packages exist which can convert abc notation into midi, produce sheet music, or play the file otherwise through the computer speaker.

As mentioned above much work has gone into software tools, that create postscript files out of this text data. The result is quite impressive, a very nice music font. One danger already apparent in the abc world is the enthusiasm of so many users, who already have started to develop their own derivatives, i.e. not keeping to the standard of the abc notation but tailoring of the language by individuals. This does result in some incompatibilities of the packages with each other, as well as many diverse types of files.

Part of the ideology of abc is shared in the FAQ section of the website, where the following is said:

> *'There have been many music software packages marketed in recent years. Some of them can do marvelous things. But all have had some major problems: They are proprietary products that typically run on only on one machine. You can't email the files to friends unless they have the same kind of computer with the same software. If there's something wrong, you just have to wait for them to fix it.*
>
> *The abc software, in contrast, uses ASCII source files that can be emailed with no known problems. The files are small, making for fast network access. The software runs on every common computer, and is mostly free, or nearly so. If you have ideas for improvements, and you have a C compiler, you can get the source and make improvements (and then share them with the rest of us).'*[6]

Creators: Chris Walshaw and alii

Price: £ 0 – Free**

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[6] http://trillian.mit.edu/~jc/music/abc/ABC-FAQ.html

3.1.3. Common Music Notation – CMN

http://ccrma-www.stanford.edu/CCRMA/Software/cmn/cmn.html

History / Purpose
CMN (Common Music Notation) is a package that is able to create and display traditional western music scores. It was initially created by Heinrich Taube as part of the larger Common Music Package. The aim of CMN was to provide a readable textual representation of a score. I.e. The basic nomenclature is that of Score or Common Music (not the music or performance). c4 is middle c, q means quarter note.

It is available free via anonymous ftp from ccrma-ftp as pub/Lisp/cmn.tar.gz. One of the main weaknesses of this packages is the remaining lack of a mouse-oriented graphical interface.

Operating Procedure / Features
CMN is free and written in Common Lisp. It works in the following systems:
- NeXTstep with ACL, Clisp, or GCL, and PCL
- SGI with ACL, GCL, Clisp, or CMU-CL
- Linux and ACL or Clisp
- Mac with MCL

CMN is a lisp program that is normally run from within the cmn package and produces an "encapsulated PostScript" file. If used within the Common Music Program it can use Midi as output but Midi input is as of yet not supported.

An example of the notation is as follows:
```
(cmn staff treble c4 q)
```


For those users who are familiar with lisp, the text based notation with its many parenthesis looks very familiar, as it uses standard lisp expressions using various standard musical names. But in general it is fairly logical and easy to understand.

CMN does support part extraction, transposition and other operations and through the ability of user defined graphical objects, modern 20th century music is catered for. Other features include feathered beams, proportional notation, unusual staff layouts, arrows, boxes, circles, al three piano pedals, harp diagrams, etc. It supports many of the 20th century percussion marks, but not as yet any early music.

Example
Here is an example of the input and output of CMN.

```
(cmn (size 24)
  (system brace
    (staff treble (meter 6 8)
      (c4 e. tenuto) (d4 s) (ef4 e sf)
      (c4 e) (d4 s) (en4 s) (fs4 e (fingering 3)))
    (staff treble (meter 3 4)
      (c5 e. marcato) (d5 s bartok-pizzicato) (ef5 e)
      (c5 e staccato tenuto) (d5 s down-bow) (en5 s) (fs5 e)))
  (system bracket
    (staff bar bass (meter 6 16)
      (c4 e. wedge) (d4 s staccato) (ef4 e left-hand-pizzicato)
```

```
     (c4 e tenuto accent rfz) (d4 s mordent) (en4 s pp) (fs4 e
fermata))))
```
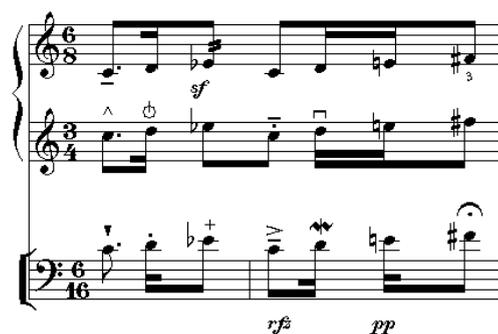

Examples taken from http://ccrma-www.stanford.edu/CCRMA/Software/cmn/cmn.html
For a more complex examples, see Appendix.

Creators: Heinrich Taube and alii

Price: £0 - free

3.1.4. Capella

http://www.softpart.co.uk/capella.html

History / Purpose
Capella is a more 'conventional' music notation package. It is designed as a low-cost alternative for those who need a fairly professionally looking score. Especially in Germany it has become very popular and it boasts more than 25,000 users in Germany alone. It is easy to use and contains online help. Input is via the mouse, keyboard or MIDI. Special symbols can be inserted via an integrated drawing program.

Operating Procedure/ Features
Capella caters for all of the basic functions needed in a music notation package catering for western traditional music. Other features include transposition, part extraction, support for copying into a word processor, play back via midi, export to midi, coloured objects, lyrics and help files. Most layout (except for slurs between staves) is done automatically, colouring is possible. It supports fonts for early music.

In general Capella is an extremely good choice for general music notation if cost is a major factor.

Example
Full examples can be seen in the Appendix.

Creators: whc GmbH, Germany

Price: **£ 119 inc VAT and delivery. For existing licence holders the cost is £ 60 inc VAT and delivery.**

3.1.5. MuTeX, MusicTeX, and MusiXTeX

http://www.gmd.de/Misc/Music/

History / Purpose
The dialiects around MusixTex have a faily long history and are varying from each other of different degrees. The developer community is divided, and with it the different development of the standard and the software supporting it.

All MusicTex derivatives are public domain and can be seen as macros for music typography, operating within the TeX typesetting system developed by Donald Knuth. Thus there is a absolute synthesis of using music notation within text if using this system. Although the inputting of music tends to very mark-up intensive, it is rewarded by providing full control over shape and placement of all musical symbols used.

Historically MuTeX, also called MTeX, was the first package to be developed by Andrea Steinbach and Angelika Schofer, originally as a master's thesis at Rheinische Friedrich-Wilhelms University in 1987. Originally it was designed for setting monophonic music and is able to accommodate lyrics, beams and slurs. Although used to some extend the developments around this language dialect have stopped. [7]

After MuTeX Daniel Taupin took up work and redeveloped a new system almost from scratch. MusicTeX was meant to cater for more advanced orchestral scores and polyphonic music, with a full range of musical graphical symbols as well as beams and slurs, able to be placed anywhere.

Two add-ons were developed by Ross Mitchell in 1993 and integrated by Andreas Egler in 1994: muflex and rmslur, enabling automatic line-breaking and page-filling. Processing was accelerated and this new system was now called MusiXTeX.

The developer community has long been divided by two different priorities within the new versions of MusixTex:
- Daniel Taupin's version prioritises backward compatibility with former versions, compatibility between MusiXTeX new features and their backward compatibility
- Andreas Egler's version prioritises compiling speed, minimization of TeX memory requirements, and beauty of the output score VS

MusiXTEX

Features for MusixTex include:
- support of scores up to six instruments, with a maximum of four staves each
- slurs and beams can be placed anywhere
- two different font sizes (20 and 16 pt)
- grace notes, ornaments, etc with smaller fonts
- available extension support for liturgical music, Gregorian chant, percussion score, chords, and others
- staves can have less than 5 lines and special clefs can be used
- unconventional bar lines are possible through specification or through full control of line elements

MusixTex is a macro package operating within the TEX environment, thus can be run on any platform running TeX. Within Tex output is converted into postscript or other graphic formats.

Example

---

[7] see Selfridge-Field, (Beyond MIDI; p222)
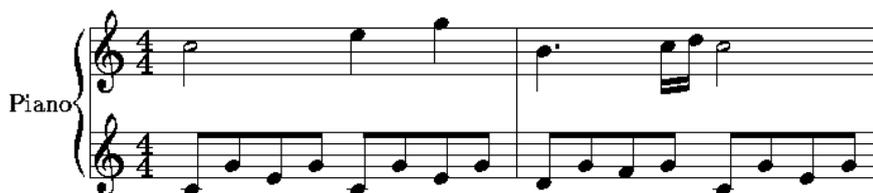
The *coding* is set as follows:

```
\begin{music}
\parindent10mm
\instrumentnumber{1}        % a single instrument
\setname1{Piano}            % whose name is Piano
\setstaffs1{2}              % with two staffs
\generalmeter{\meterfrac44}% 4/4 meter chosen
\startextract               % starting real score
\Notes\ibu0f0\qb0{cge}\tbu0\qb0g|\hl j\en
\Notes\ibu0f0\qb0{cge}\tbu0\qb0g|\ql l\sk\ql n\en
\bar
\Notes\ibu0f0\qb0{dgf}|\qlp i\en
\notes\tbu0\qb0g|\ibbl1j3\qb1j\tbl1\qb1k\en
\Notes\ibu0f0\qb0{cge}\tbu0\qb0g|\hl j\en
\endextract                 % terminate excerpt
\end{music}
```

Examples taken from MusixTeX Manual, ftp://ftp.gmd.de/music/musixtex/musixdoc.ps
For a more complex examples, see Appendix.

Creators: Andrea Steinbach, Angelika Schofer, Daniel Taupin, Andreas Egler, Werner Icking, Ross Mitchell
Price: £ 0 free

3.1.6. Rosegarden

http://www.bath.ac.uk/~masjpf/rose.html

History / Purpose
Rosegarden calls itself an "integrated MIDI sequencer and musical notation editor"[8]. Again a small number of enthusiasts have put quite some efforts into this package, which although not really comparable with other packages outputwise, is very interesting as a research, developer's package in which you need sequencing functionality. Of course, if you compare it to packages like Cubase and Cakewalk, both able to handle notation graphically and sequencing professionally, it might not even be able to get a score, but on the other hand, the source code availability makes it interesting if you need something to develop to your own needs and don't want to start from scratch.

The developers have announced a total new rejigging of the underlying technology, so there are major changes ahead.

Operating Procedure / Features
It is free software and runs on Unix and X, (SGI IRIX, Linux PCs, OpenVMS)

It uses 'conventional input and output procedures, and is

> *'a musical notation editor supporting multiple staffs with chords, manual and automatic beaming, dynamic markings, slurs, ties, textual marks, triplets and various other conveniences a MIDI sequencer and editor with textual event and piano roll display tool integration allowing music in MIDI form to be viewed and edited as notation, and notation to be sequenced a scripting language (Petal) for writing filters to process MIDI tracks and notation staffs.'* [9]

---

[8] http://www.bath.ac.uk/~masjpf/rose.html
[9] ibid.

Features include:
- ability to produce Csound output
- musicTeX output for typesetting and printing
- comprehensive hypertext help
- portability to several flavours of Unix
- midi out
- mostly POSIX-compliant ANSI C code
- Example

Examples
Non available at this time.

Creators
Rosegarden was written by Chris Cannam, Andy Green and Richard Bown, with contributions from Guillaume Laurent and John ffitch.
Price: £0 - Free

3.1.7. Composer's Pen

Real Composer's Pen seems to be outdated and seems to not be available for the current OS anymore. No information was available at the point of writing. If readers have some knowledge of this package, please email the authors.

3.1.8. Lime

http://www.cerlsoundgroup.org/cgi-bin/Lime/Windows.html

History / Purpose

David Cottle and Lippoold Haken describe Lime as being

> '... the successor to a group of programs developed by the Sound Group at the universities of Illinois Computer-based Education Research Laboratory (CERL). CERL began developing programs for the management of musical information, with a primary emphasis on printing, in 1974. The music printing programs were originally written for the mainframe educational computer system (Plato) developed at CERL, and they are still actively used on that system, In this context an ASCII text-based system, OPAL, is used for music representation. OPAL is a score description language that holds much in common, in its overall organization and comprehensiveness, with Humdrum Kern and MuseData systems of representation. (...) LIME provides extensive capabilities for defining scores of Western classical music. It has also been used for the transcription of pre-tonal, experimental, and non-Western musics, as well as popular music, jazz, and microtonal music. LIME allows for MIDI input and playback, but sequencing is not a priority.'[10]

Within this long developmental period, this little packages has acquired a high quality output with a very intuitive and easy accessible user interface.

Operating Procedure / Features
Lime operates on Windows95/98/2000 and Macintosh. Lime provides wide-ranging capabilities needed to represent Western classical scores. It has been used for non-traditional music, pre-tonal, microtonal.

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[10] Selfridge-Field, Beyond MIDI; pp283 – 4

It's scopes encompasses all forms of music notation described in Kurt Stone's "Music Notation in the 20th century"[11]

A lime file, also called TILIA music representation file, is in binary format (i.e. not text based as most of the above described packages). It has Midi in and output, as well as playback. Lime scores ca n be copied and pasted into word processing or other publishing packages. A nice feature is the export and import of NIFF, the notation interchange file format.

Example
Here is and example of *LIME*'s output.
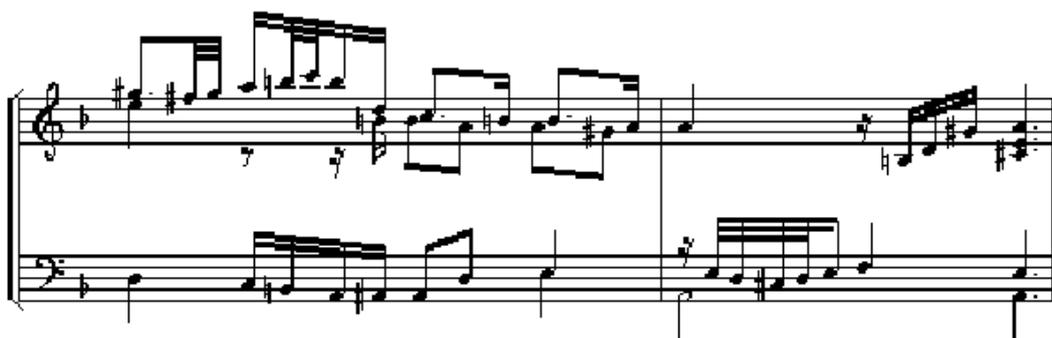
Examples taken from Lime Manual

Creators
Lime was written by Lippold Haken and Dorothea Blostein. Version 4.0 was first released for Macintosh in 1996 and had been developed as as part of a group of programs coming out of the CERL Sound Group (Computer Based Education Research Laboratory). With contributions from Paul Christensen.

Price: £ shareware – free for a limited evaluation / appraisal period (US$65 for an individual license)

3.1.9. Mozart the Music Processor

http://www.moz art.co.uk/

History / Purpose
Mozart was also one of the packages conceived and worked on in the 80's, conceived as a musical typewriter with the aim of easing the process of inputting music by automating as much as is reasonably possible. Mozart is distributed as Shareware, which means that evaluation copy is freely available. But its terms of use, as with much shareware, restrict you to a limited evaluation period.

It has a graphical input screen and runs on Microsoft Windows. Mozart allows you to type in music notation view it on the screen, hear it, edit it, and then print scores and individual parts for musicians.

Development has been ongoing up to the time of writing, and there seems to be a continued interest of both a user community and the developers to continue to support this package.

As Lime, it has put quite some efforts in providing an intuitive and easy user interface which is musically relevant and has succeeded in this.

Operating Procedure / Features
OS Windows 95, 98 and WindowsNT.

---

[11] New York: W. Nortin, 1980

Example
Here is an example of the input and output of Mozart.

Taken from http://www.mozart.co.uk/images/solace.gif

Creators
David Webber

Price: £ shareware – free for a limited evaluation / appraisal period, full license: UK£ 49.95

3.1.10. Overture 2 (Cakewalk home studio, Score Writer and Overture)

http://www.cakewalk.com/

History / Purpose

Although actually a commercial product, it features in this list of notation packages as it has been developed in the past as primarily a part in a larger sequencing suite. In general, most professional sequencers do not yet accomplish to produce a score output of the quality needed for serious music publishing. In fact most of them are still far behind the available free and shareware packages. Nevertheless, their integration into midi sequencing suite has attracted many users to go for them, and if not used for professional publishing they do form a very interesting variant for music notation.

In this case, Cakewalk has further developed their notation packages, their first being the Note Editor which came with all the Cakewalk home Studio Sequencer Package. A more advanced and functional version of this "Score Writer" was developed to cater for the sing-writing and sheet music market, where speed is of essence and only popular music is catered for. The most advanced notation package of Cakewalk is Overture 2, which is described here, which tries to compete with all the other professional notation packages.

Overture, the notation package from Cakewalk promises to be a

> *'... easy-to-use notation software that's powerful enough to satisfy the needs of today's professional musicians and composers. You can quickly enter notes on-screen with your mouse or computer keyboard, or record a MIDI performance for instant viewing. Overtures intuitive interface puts powerful editing tools and symbol palettes at your fingertips, so you spend time composing music instead of searching through menus. For complete orchestral arrangements, lead sheets, individual cues or even simple notation examples, there's no faster way to create professional notation than Overture 2.'[12]*

Operating Procedure / Features
Available for Macintosh and Windows 95/98. Overture has a nice graphical user interface bin which the tools can be positions anywhere on the interface. Other features include:

- 256 staves with 8 voices per stave.

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[12] http://www.cakewalk.com/Products/OV/OV2.html

- 64 staves per system, unlimited number of systems.
- Scrolling score window during playback.
- Input via mouse, computer keyboard or MIDI keyboard.
- All elements (notes, stems, beams, accidentals, ornaments, fingerings, staves, clefs, barlines, all text) can be selected and dragged with arrow keys.. .
- exporting of sections into word or publishing packages (by saving bselections as pict/eps first)
- Drum Mappings, Smart Tablature, Guitar Palette , Jazz Articulations
- Expression Library , Expression palette , Engraver settings
- Libraries for: allotment table, chord symbol, drum maps
- MIDI playback: as recorded (MIDI data), as written or in swing
- Templates using System 7 stationery
- Transposition

Although the output is relatively high quality, the package cannot deny its origins, to lie predominantly in the sequencer market and popular music community. Within this community, it is a serious contender.

Example
Here is an example of the output of Overture.

Taken from http://www.cakewalk.com/Products/OV/OV2.html
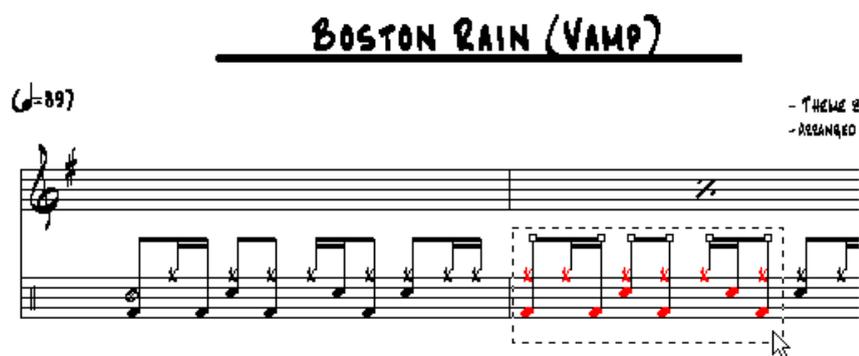
Creators: Cakewalk

Price:

3.1.11. Cubase VST – Note editor support

http://www.steinberg.net/infocenter/discoveries/products/cubasevst.phtml?sid=08234765#top

History / Purpose
As with Cakewalk, also Cubase has integrated a note editor into its sequencing suite. Its full integration into midi sequencing has attracted many users. For users targeting sequencing and a popular music sector where high quality score output is secondary to fast efficient handling of music and score, this is a very interesting variant for music notation. Like Cakewalk, although the output is reasonable high quality, the package cannot deny its origins, to lie predominantly in the sequencer market and popular music community. Within this community, it is a serious contender.

3.1.12. Music Publisher 32

Publisher 32 is a graphical music editing program, which only concerns it self with how your music looks, rather than how the music will sound. This makes it very easy f or t he MPScan to re-create your original score in the Music Publisher 32 program for further editing. Note that Music Publisher does not

contain any MIDI features such as playback or recording. It doesn't bother with enforcing any musical rules, so you can create scores exactly how you want them to look!

3.2   STANDARDS AND FILE FORMATS

3.2.1. SMDL

History / Purpose
Defined as "an architecture for the representation of music information, either alone, or in conjunction with text, graphics, or other information needed for publishing or business purposes" SMDL was historically in its development closely related to HyTime and is expected to be published in its revised form with compatibility with XML and HyTime2 in 2000., which was orginally taken up by the US Defense Department.

SMDL (Standard Music Description Language) is a HyTime application that conforms to international Standard ISO/IEC 10744.
There are four domains in SMDL:
- logical domain - contains the abstract musical content , described as "the composer's intentions with respect to pitches, rhythms, harmonies, dynamics, tempi, articulations, accents, etc.". It contains any number of `cantus' elements.
- gestural domain - contains any number of performances, each of which specifies how and where components of the logical domains are rendered in a specific performance, as in "the information added by performers".
- visual domain - contains any number of scores, each of which specifies exactly how components of the logical domain is rendered visually, as in "the information added by human editors, engravers, and typesetters".
- analytical domain - comprised of any number of theoretical analyses.

The process of creating an SMDL document instance involves generating a logical domain from a score or a performance, and (optionally) of generating a visual or gestural domain which represents all the correspondences between that score or performance and the logical domain. The relationships between the different domains are created using hyperlinks which may connect chunks of multimedia materials as well.

Not being interested in the music-side of things, rather only in the time-based structures, SMDL was created (loosely speaking) by extracting the music side out of HyTime. Nice aspect about it is that it is an ISO standard, thus is more secure against any commercial or private pressures in order to change it. But only a few browsers handle it, and these are not available for all platforms. It is unbelievable that there has existed a very well defined standard (700 pages) for about three years, without a critical mass of developed applications.

As of yet, it is solely an encoding standard, and does is supported by only some prototypical WYSWIG editors or viewers coming from individual research projects. as only a matter of time, these editors could and would make this standard much more acceptable as an interchange file format or as an underlying data format for an editor. But as the standard is an accepted ISO standard and it is platform independent and non-proprietary, it has a promise which other proprietary formats of other notation packages simply do not promise.

Operating Procedure / Features
The process of creating an text based SMDL document instance involves generating a logical domain from a score or a performance, and (optionally) of generating a visual or gestural domain which represents all the correspondences between that score or performance and the logical domain. The

relationships between the different domains are created using hyperlinks which may connect chunks of multimedia materials as well.

Example:

```
<ces id=ces2 repeats=2>
 <pitched exspec=quarter>
 <nompitch><gampitch><pitchnm>e</pitched>
 <pitched exspec=quarter>
  <nompitch><gampitch><pitchnm>g</pitched>
<pitched exspec=dquarter>
    <nompitch><gampitch><pitchnm>g</pitched>
<pitched exspec=eighth>
    <nompitch><gampitch><pitchnm>a</pitched>
```

Creators: Stephen Newcomb, Elliot Garner

3.2.2. NIFF (Notation Interchange File Format)

History / Purpose

As Stephen Mounce writes in his introduction to NIFF:

> *"The NIFF project began in February 1994 with a meeting between technical people repre-senting three major music notation programs and three music scanning programs. The group's goal was to define a new standard format for exchange of music notation data, which everyone agreed was long overdue in the industry.*
> *The original companies involved were: Passport Designs (publisher of Encore), San Andreas Press (Score), Coda Music Technology (Finale), Musitek (MidiScan) and TAP Music Sys-tems/MusicWare (NoteScan). The list of advisors has continued to grow over time.*
> *In January of 1995 Coda decided to withdraw from the process (with the intention to publish their own Enigma format). Shortly thereafter, Mark of the Unicorn, Twelve Tone Systems, Opcode Systems, and TAP Music Systems/MusicWare agreed to replace Coda as financial sponsors."* [13]

Thus NIFF is the result of more than two years collaboration between major music software publishers and experts in the field of music notation/representation. NIFF files include graphical object and page layout as well as MIDI performance information.

Up to now, MIDI files have been the de facto standard for exchange of music data between programs. Although this is sufficient for playback, it is inadequate for displaying and printing of music notation. NIFF tried to answer this need with a dedicated notation score representation with its major functionality of being an interchange file format.

To sum up the positive characteristics of NIFF:
- platform-independent interchange
- intended to preserve a significant amount of visual detail
- allows representation of the most common situations occurring in conventional music

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[13] Stephen Mounce (ed), "Niff Homepage", http://www.student.brad.ac.uk/srmounce/niff.html, 1/11/00

- makes provision for software developers to define their own extensions to handle the more unusual situations
- allows inclusion of Encapsulated PostScript (EPS) files and fonts to allow interchange of features not otherwise defined in the format
- the standard is open and non-proprietary.
- there are Software Developers Kits (SDKs) available

Both SMDL and NIFF seem stable enough to start developing SMDL based and NIFF compatible applications. Although one may be aware of the fact that other standards are much more accepted and hyped within the music industry, and that both NIFF and SMDL are not accepted by it, they still seem to be the only standards powerful enough and close enough to being officially standardized, for developers not to be prone to the danger of working towards moving goal-posts.

Operating Procedure / Features
NIFF format is a binary format, which implies one cannot edit files. For developers, who want to make their applications NIFF compatible there is a Developer's software kit with source code, allowing the writing and the reading of NIFF through C code routines. As such NIFF is only interesting for researchers and developers at this moment, but its acceptance may one day close the hole of an interchange file format for score and notation packages.

Creators: Cindy Grande, Alan Belkin

3.2.3. GUIDO

http://www.informatik.th-darmstadt.de/AFS/CM/GUIDO/

History / Purpose
GUIDO is a text based music encoding standard, but with specialises of being 'representational adequate', i.e. simple example calls for simple encoding, complex calls for complex examples. This makes it easy to use when needing a fast textual input or if sending by email. It's developers define it to be a

> " … general purpose musical notation format; the intended range of application includes notation software, compositional and analytical systems and tools, performance systems, and large musical databases. It is powerful, flexible, easily portable, and human readable. "[14]

The GUIDO developers have developed the GUIDO Note Server which creates a GIF out of any GUIDO format. This makes it very interesting for dynamic music representation over the web.

The GUIDO Music Notation Format is named after Guido d'Arezzo (990-1050), the renowned music theorist of his time and important contributor to today's conventional musical notatio.

Preliminary work on the GUIDO Music Notation Format originated in 1992/93, when first prototypes of the SALIERI System and Language were designed and implemented. Later, as part of the SALIERI Project (Characterization of Algorithmic Aspects in Music) the range of the SALIERI Project was significantly extended. The essential concepts of the GUIDO Format were designed by Holger H. Hoos and a small developers group, the SALIERI Project group at the Technical University in Darmstadt / Germany has continued the development until now. Since 1997, the GUIDO development and design is supported by Keith A. Hamel, author of the professional notation programs NoteWriter and NoteAbility. [15]

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[14] http://www.informatik.th-darmstadt.de/AFS/CM/GUIDO/
[15] http://www.informatik.thdarmstadt.de/AFS/CM/GUIDO/about.html

Operating Procedure / Features
As the developers imply "The GUIDO design is strongly influenced by the objective to facilitate an adequate representation of musical material, from tiny motives up to complex symphonic scores.". This makes simple examples simple, complex examples complex.

Language Specification, Examples for its usage and tools for manipulating GUIDO files are freely available from this website. Already there is a fast growing user community implementing and integrating this standard into a variety of applications such as notation software, compositional and analytical systems and tools, performance systems, and large musical databases and music educational applications.

Example
Simple example:
[c d e f g a b]

More complex Example:

2 voices, 2 staves; dynamic markings in first voice

{ [\title<"No.3"> \tempo<"Andantino">
 \staff<1> \clef<"g"> \key<+1> \meter<"3/8">
 \i<"p"> d2/8 |
\sl(\dim(d h1)) h
\sl(\dim(h g)) g
\sl(\cresc(f# a c2))
\sl(c h1)],
[\staff<2> \clef<"g"> \key<+1> \meter<"3/8">
 _/8 |
 h1 _ _
 g _ h0
 \sl(c1 f# a)
 \sl(a g)]
}

Creators
Holger H. Hoos, Kai Renz, Kai Flade, Jürgen Kilian, Thomas Helbich, Prof. H.K.-G. Walter, Prof. Keith A. Hamel, Prof. Rudolf Wille

3.2.4. ETF (Finale Enigma Transportable File)

History / Purpose

ETF is the answer of CODA/Finale to the need of having a interchange file format for exchanging score data between applications and platforms. "An ETF, or ENIGMA Transportable File, is a text-only file that can be transferred easily between the Macintosh and IBM-PC compatible computers. You do not have to save doc-uments as ETF files to read cross-platform files. Standard Finale files can be read by either platform."[16]

Operating Procedure / Features

In Enigma terminology, an "entry" is either a note, a chord, or a rest. Entries are streamed together in a doubly linked list that roughly corresponds to a voice on a staff. Each entry can have up to twelve notes.

As can be seen from the example below, for the normal user this formay is useless. For developers it can become interesting, whereas one of the major disadvantages is that this standard is proprieatary and may be subject to change at any time CODA sees it of advantage to change it. This makes it not a good choice for integration into applications, if there is a need for an exchange file format.

Example

Here is a typical entry pool from an ETF, with annotations:

```
^eE(1) 0 2 1024 0 $C0000800 128 3 <<== entry
48 $80030000 <<== note
80 $80020000 <<== note
112 $80010000
^eE(2) 1 3 1024 0 $C0000800 128 1
128 $80010000
^eE(3) 2 4 1024 0 $C0000800 128 3
48 $80010000
80 $80020000
112 $80030000
^eE(4) 3 0 1024 0 $C0000800 128 1
48 $80010000
```

Each entry is signified by the tag ^eE with the entry number in parentheses. The line containing the ^eE contains information that pertains to the entry as a whole. Information about individual notes within the entry follows on zero or more subsequent lines. (NOTE: All numerical values in an ETF are in decimal unless preceded by a '$', in which case they are in hexadecimal.)

Creators: CODA Ltd

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[16] FINALE Documentation, p. 1-22

3.3. SCANNING SOFTWARE

Due to the time limit of our Evaluation period, even the scanning packages inbuilt into the main packages were unable to be evaluated. Nevertheless we found it useful to gather information from the different packages available and include it into this documentation.

3.3.1. Photoscore Lite (inbuilt with Sibelius) and Photoscore Full Version

(mac/win)
Price: Lite comes free with Sibelius, the full vesion costs ca US$350 - 370
PhotoScore Lite is plugin for Sibelius. Thus it is directly integrated with a powerful notation package. Process for the whole procedure is: 1. Scanning, 2. Editing (optional), 3. Uploading into Sibelius. The lite version is restricted to notes, excluding textx, dynamics, articulation, and other items.
The full version is faster and more accurate. It should be able to read notes and chords, articulations, texts, dynamics, any other markings. Clefs, key and time signatures, etc. It is surprisingly accurate. Critics indicate that there are weaknesses in picking up text and markings scanning, although we haven't been able to test this. The quality of acuretness does depend on the type of score you have, but it should diminish immensely the work of inputting large masses of music from paper, if you have the right kind of score.

3.3.2. SmartScore, Full and Piano Edition

(mac/pc)
Price: ca $350 - 400, price reduction for academic use, ca half the price for the piano edition
SmartScore can scan, edit, arrnage, transpose and print music. Not having enough editing support to be a fully accepted notation package, its scanning facility is good. Again it does need some experiemntation with the best resolution for the scanner, to get the best results.
The piano edition constricts the musci to be scanned to one or two staffs. It does allow midi import, but in the piano edition there is not support for arranging, transposing, sequencing or recoring from midi.

3.3.3. MidiScan / SmartScore (inbuilt with Finale 2001) PC Only

(pc)
price: ca US$ 200
Scans music and saves it as midi. It does have restrictions of length to 24 pages and only scans the notes, excluding dynamics, texts. etc.

3.3.4. PianoScan

(pc)
price: ca 100
Scans music and saves it to Midi. (upto two midi tracks for scores with 2 staves)

3.3.5. MPScan

Price: ca $100
MPScan is part of the MusicPublisher package, but has to be bought separately. It does need Music Publisher 32 to work.

3.3.6. NoteScan (compatible with Nightingale)

(mac)
price ca $200

NoteScan is a free plugin for Nightingale and is fully integrated into it. It is able to scan notes, layout, markings, positioning and formating, beaming, accidentals, keys, etc. It sends the scanned data directly to Nightingale.

CONCLUSIONS

From the above it can be seen that there are numerous types of music notation packages because there are a wide variety of uses and users that need to be catered for. Some packages focus more on the publishing and print-music perspective, while others come from a more intuitive and compositional stance, and yet others try to accommodate all users an all types of use. Therefore, how does a music community decide upon the correct package for them?

Academic music publishers – who generally need professional output and speed of input may be best advised to opt for one of the main and most expensive and most supported packages such as Sibelius and Finale, but also Calliope (especially for departments specialising in medieval notations), although it has the disadvantage of not being officially supported by a body or company. Nightingale also has a lot of capabilities for fine-tuning, and if they have the time to invest, the option to learn and master Score could be a valuable skill.

All too often, however, investment is made in these professional packages unnecessarily: if the majority of their curriculum is based on **MIDI keyboard (sequencing and synth input)**, Cakewalk or Cubase may be a good choice as both have fairly acceptable notation packages integrated. Both are being supported by larger companies.

Alternatively, at a lower cost, if their needs only extend to getting a **fast but reasonable good printout** – but not imperatively professional, then Nightingale, Lime, Mozart or Capella may be suitable, at a fraction of the cost. These packages may be all you need for including examples in your next article or book.

Professional typesetters would be best served by the professional packages: Finale, Sibelius and Score – and if it overcomes some of the difficulties mentioned, NoteAbility. All of these offer a wealth of fine-tuning capabilities. Nightingale may also be an option for this type of user as it, by means of its NightCustomizer menu, enables the package to be customised, and is also designed to be compatible with publishing conventions (Master Pages) and packages such as Quark and PageMaker.

If **full control over graphic items** is needed, but no need for music relevant input, or efficiently fast input or if there is a existent knowledge of typesetting programs, such as latech, tex, etc, then Lilypond and MusixTex maybe a very good option, although one has to be prepared for a steep learning curve.

The packages best suited to **multi-networked environments** would be Unix based packages, such as Notability, and Calliope. Also Lillypond and MusixTex, as these packages allow network installations, but with the restrictions described in above paragraph. But also Sibelius is trying to put some development into this, proven by the availability of a network license, although many problems are still existent with this type of license.

Professional composers and performers would need to judge and match their needs in relation to the needs expressed above. Again, it should be stressed that if an all-singing, all-dancing package is wanted, there is a price to pay. Oftentimes there are suitable, cheaper alternatives that get passed over in favour for the bigger names.

Novice, or first-time users on the other hand, may be best advised to approach more user-friendly packages, such as Sibelius or Cappella to ease learning and gain confidence.

For those users who are keen to publish or communicate via the **Internet**, Sibelius and Finale have inbuilt web features that are easy to use and produce results quickly and efficiently. There are also other packages that support Internet file formats and standards such as GUIDO, as for instance Notability.

Other, more **experienced users, who want to customise, expand and enhance the capabilities** of their package may find it worthwhile to invest in Sibelius and Finale, which both offer developer and programming features, or packages such as MusixTex or Lilypond or CMN, Calliope that are either

shareware, freeware, or where the author is keen to allow and encourage input from users, and where there is an interactive user and developer community.

It is generally worth assessing and prioritising you needs, and looking around at what is on and beside the market – unless there are no budget or compatibility restrictions. Although the level of support may be naturally less for the smaller packages – it is normally a labour of love, there are shareware and freeware packages available that, if nothing else, are worth a go. This is especially important in a higher education and multi-user environment where cost and compatibility implications are far reaching, and the selection of a music notation package is an investment into the livelihood of the department and music community, as a whole. It was with these thoughts in mind that this evaluation was undertaken.

APPENDIX 1: MUSIC EXAMPLES

In order to gain experience of the packages, four musical examples (lute, 'traditional', guitar and 'avant-garde') were selected to test the packages as fully as possible. The lute example – (see below) – was tricky for most packages insofar as it required capabilities for numeric lute tablature. The 'traditional' example – (see below) – was handled well by all packages. The guitar extract – (see below) – did cause problems for those packages not catering for TAB, but in general, the lyrics and music were handled well. The 'avant-garde' extract – (see below) – was very testing as it required partially hidden staves and graphics, but most of the packages could be manipulated to help produce the notation – except for partially hidden staves – and some catered very well with this example.

LUTE

The first two-and-a-half lines were input. The numbers on the base lines of the stave were coloured red. (*Libro Sexto* by Orphenica Lyra Fuenllana. From Handbuch der Notationskunde, p161, Breitkopf & Hartel, 1963)

'TRADITIONAL'

The last four bars of this page were input. (String Quartet: *A Musical Joke.* From the third movement of Mozart's *Ein Musikalischer Spaß: Dorfmusikanten – sextett* K.-V No. 522, p10, Ernst Eulenburg, n.d.)

GUITAR

The first five bars of this page were input. (*Politicalamity* by Extreme. From *III Sides to Every Story*, p42, Wise Publications, 1992)

'AVANT-GARDE'

The first six staves were input. (*Polymorphia* by Penderecki. From *Polymorphia*, p21, Hermann Moeck Verlag, 1963)

In order to facilitate some sort of comparison between the printed output of the packages, all of the files have been printed out, scanned via Deskscan II and Photoscore Lite, and saved as bitmap images to aid in comparison across platforms. Two of the files – <u>Score</u> and <u>Nightingale</u> – were saved as EPS and exported into the Openstep environment before printing and scanning as we did not have a Mac-compatible printer hooked up to <u>Nightingale</u>, and as we did not have an EPS viewer available from our Windows environment for <u>Score</u>. The results of the 'traditional' example for each package can be seen below.

CALLIOPE

Calliope: extract from Mozart's *A Musical Joke*

FINALE

Finale: extract from Mozart's *A Musical Joke*

NIGHTINGALE

Nightingale: extract from Mozart's A Musical Joke

NOTEABILITY

NoteAbility: extract from Mozart's *A Musical Joke*

1

SCORE

Score: extract from Mozart's A Musical Joke

SIBELIUS

Sibelius: extract from Mozart's *A Musical Joke*

GNU LILYPOND

Ständchen
(Serenade)
Leise flehen meine Lieder

Text by Ludwig Rellstab (1799-1860)

Franz Schubert (1797-1828)
D. 957 No. 4

Piano

Taken from http://www.cs.uu.nl/~hanwen/lilypond/mutopia/F.Schubert/out -www/standchen-page1.png

ABC

Taken from http://www.ucolick.org/~sla/abcmusic/s7m2mp.pdf

CMN

mensuralisation by Petrucci (1498) (as a standard in transcribing in print)

MUSIXTEX

Examples taken from MusixTeX Manual, http://www.gmd.de/Misc/Music/scores/benoit/

GUIDO

Taken from http://tempo.iti.informatik.tu-darmstadt.de/salieri/nview/Release0_20.html

APPENDIX 2: OTHER USERS' OPINIONS

Other user's opinions of the packages gained from workshops – where users of all experience levels were asked to input music examples and feedback was obtained – and from distribution of the questionnaire. The majority of workshop participants were not familiar with music notation packages and all had a set time within which to complete the example. The following comments are not organised in any particular manner within each subheading, and are taken directly from completed questionnaires.

CALLIOPE

In general, feelings about <u>Calliope</u> were mixed. It was felt to be a difficult package to access by the majority of users – which the poor support / help facility - exacerbated, however more experienced users seem to be aware of its potential and capabilities for producing professional results.

Typical Comments were as follows:

- *Things you'd like to be intuitive in this package (like alignment) aren't. Things you don't want to be intuitive (like stems) are.*
- *The programme is very difficult to follow for a beginner. Very unclear.*
- *The programme is very unhelpful. It could be a lot more straightforward.*
- *Not many problems once used to it, but couldn't play into it from the keyboard, and it didn't show leger lines – had to guess then manually move to the correct place.*
- *You have to fish around for most things. Poor support / help from the package – lots had to be done manually which wasted time.*
- *Couldn't erase without going to Edit then Cut.*
- *Good for composition of non-conventional or medieval music.*
- *It does exactly as you tell it.*
- *The package was hard to understand.*
- *The tool bar should be a little more exhaustive, so that the user can get any function as quickly as possible.*
- *Only experience can help.*
- *Freedom makes this package enjoyable, but ease of use could be improved.*
- *Very easy to manipulate objects. Easy to get the score looking good.*
- *It is not as mathematical as others I have used so it does not do as many calculations for note length etc., but that is why it can be used 'with freedom'.*

FINALE

Opinions varied concerning Finale. Some found it easy to use and straightforward, while others seemed to find it more difficult to come to terms with. Despite this, most users acknowledged the power of the package and its vast range of capabilities.

Typical Comments were as follows:

- *I like the concept of music being created on a continuum in Finale (not just one page with Sibelius).*
- *Finale didn't make things easy. Tools were hidden and menus changed according to the tools selected – annoying. There was no common interface with other music packages or even other GPP's.*
- *Finale is good as far as applying notes and their values (…) the ability of the package would encourage me to use it again.*
- *More time needed to get to know the package.*
- *Not much help from the package – symbols are not very explanatory to the job they are supposed to do.*
- *Fairly easy to use – nice graphics.*
- *Un-obvious help files.*
- *Very nice looking and flexible with a lot of advanced features.*
- *The flexibility within features meaning you can create virtually any thing you want makes it enjoyable.*
- *It would be nice to select individual entries for editing without needing to change tools.*

- *Intuitive, takes time to explore new features.*
- *Easy to use and deep features.*

NOTEABILITY

Again, there was mixed feedback with this package. The help and tutorials were commended, but actually using the package seemed to take a bit longer to get used to. Novice users seemed intimidated by the wealth of options available initially, but this flexibility of use was commended by more experienced users.

Typical Comments were as follows:

- *Good step-by step learning method / introduction.*
- *Easy to use shortcuts.*
- *Hand drawing slurs was useful but took a little while to get used to.*
- *I didn't use the 'help' function since, in general, it was quite simple to sort out problems just using the tools.*
- *I liked the freedom of this package. However, there seemed to be some problems with the actual package i.e. freezing.*
- *To add articulations etc. you had to select everything i.e. note + staccato before putting the note in – you couldn't add an articulation after the note. The inputting scroll bar had to be exactly spaced.*
- *The package seems unable to perform tasks 'intelligently' i.e. you have to tell it everything, including note spacings.*
- *The package is extremely tricky to operate. However, it seems to have good help menus, and 'tutorial' options which (…) help a lot.*
- *Very complex format and the blue box [entry cursor] controlled where you were to put the note meaning you would have to move it all the time.*
- *Very fiddly to place notes (cursor moves each time).*
- *Many functions are not immediately obvious.*
- *Had initial trouble in getting accustomed to how the package worked.*
- *Over-complicated structure of the package. Layout of tools could have been made easier.*

SCORE

Typical Comments were as follows:
- *bad in that one needs to learn textual short cuts or dos commands*
- *as being DOS program, the use in windows is restricted*
- *looks oldish*
- *not wysiwyg*
- *like using only computer keyboard to input music, keeps movement down to a minimum*
- *good for advanced users*

SIBELIUS

The majority of users found this package to be very straightforward and easy to use, and its reputation proceeds it – as the comments of one user highlights: 'Don't have a wide range of knowledge, but Sibelius sounds good'. Some users did feel that there were constrictions within the package, and the help was not as highly commended as in other packages.

Typical Comments were as follows:

- *Trying to get f, ff, ppp problematic.*
- *I would choose Sibelius because I am a beginner and it's quite easy to use, very good to experiment with.*
- *You are very much supported by the programme concerning what is and isn't possible.*
- *Easy to get into and produces results which immediately look good.*
- *I thought the textured background was a neat touch.*

- *The scrolling method of clicking and dragging on screen [navigator], while it is modern and clever, is an utter pain.*
- *User-friendly – fast working, easy to use.*
- *I used it easily without tuition or the available help manual.*
- *Very similar to text packages i.e. CTRL and shift selects note and delete.*
- *Having to use drop down windows for basic things becomes tedious.*
- *Sibelius does not allow enough freedom: e.g. it is difficult to get rid of bar lines.*
- *Basic drawing tools / shapes could be improved.*
- *The Help section [could be improved] – clearer guides / instruction. Often hit or miss when inputting notes using the mouse, therefore have to drag note into position.*
- *Simplicity, no faffing about, looks very professional when printed out, connected to MIDI.*

APPENDIX 3: QUESTIONNAIRE

Basic questionnaire distributed to a wide variety of users of music notation packages, and adapted for workshops.

SECTION 1A: YOUR MAIN NOTATION PACKAGE

1.1   What is the main musical notation package that you currently use?

1.2   Why have you selected this as your primary package?

1.3   What do you use this package for: composition, preparing notes, for pleasure?

1.4   What features make this package enjoyable?

1.5   What features do you think could be improved?

SECTION 1B: SECONDARY PACKAGES

1.6   Do you use any other notation packages?

1.7   Why do you use these in addition to your main package?

1.8   What platform – Mac or PC – do you use for these packages, and why?

1.9   What do you use these subsidiary packages for: composition, preparing notes, for pleasure?

1.10   What features make this package enjoyable?

1.11   What features do you think could be improved?

SECTION 2: SOME GENERAL QUESTIONS

2.1   Have you used any other notation packages in the past?

2.2   Are there any specific reasons why you choose not to use them now?

2.3   What features in other packages have you most enjoyed?

2.4   What features in other packages have you least enjoyed, and how could these have been improved?

2.5   What general factors influence your choice of package?

2.6   What specific features do you look for in a notation package?

2.7   Is there anything that you would like to see catered for in a notation package that you feel is currently lacking?

2.8   Any other comments?

REFERENCES

The majority of these packages are constantly being updated and improved. For further information on the latest developments and versions please contact:

CALLIOPE

Website: http://www.cl.cam.ac.uk/~wfc/calliope-further.html
Email: William.Clocksin@cl.cam.ac.uk
Address: W.F. Clocksin
              Computer Laboratory
              University of Cambridge
              New Museums Site,
              Pembroke Street,
              Cambridge
              CB2 3QG
              UK

FINALE

Website: http://www.codamusic.com/coda/fin2000.asp
Email: finalesales@codamusic.com
Address: Coda Music Technology
              6210 Bury Drive
              Eden Prairie, MN
              55346-1718
              USA.

NIGHTINGALE

Website: http://www.ngale.com
Email: info@ngale.com
Address: Adept Music Notation Solutions, Inc.,
              33 Riverdale Road Yardley,
              PA 19067
              USA

NOTEABILITY

Website: http://debussy.music.ubc.ca/~opus1/NoteAbility/NAwelcome.html
Email: opusone@interchange.ubc.ca
Address: Opus 1 Music Inc.
              Hillcrest R.P.O.
              P.O. Box #74049
              Vancouver, B.C.
              V5C 5C8
              CANADA

SCORE

Website: http://www.scoremus.com
       Or   http://ace.acadiau.ca/score/links3.htm
Email: lcs@scoremus.com
Address: San Andreas Press,
              P.O. Box 60247,

Palo Alto,
California 94306
USA

SIBELIUS

Website: http://www.sibelius.com
Email: infoUK@sibelius.com
Address: Sibelius Software Ltd
               66-68 Hills Road
               Cambridge
               CB2 1LA
               UK

A useful website listing various music notation packages is http://ace.acadiau.ca/score/others.htm as is http://www.medieval.org/emfaq/scores/software.html. Information on JISC and JTAP can be found on http://www.jisc.ac.uk and http://www.jtap.ac.uk and the UCISA website is located at: http://www.ucisa.ac.uk.

In addition to the above references, the following websites, books and articles may be of interest.

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http://alpha.science.unitn.it/~oss/notation.html
Title: Programmi per la Notazione Musicale
Maintainer/ Author: Dennis O'Neill
Last Accessed: Aug 2000

http://www.etcetera.co.uk
Title: Etcetera Distribution
Maintainer/ Author: Etcetera Distribution
Last Accessed: Aug 2000

http://kellysmusic.mb.ca
Title: Kelly's Music and Computers
Maintainer/ Author: Kelly's Music and Computers
Last Accessed: Aug 2000

http://www.musicwareinc.com/prod02.htm
Title: Musicware Inc – Nightingale and NoteScan
Maintainer/ Author: Musicware Inc
Last Accessed: Aug 2000

http://www.newnotationslondon.freewire.co.uk
Title: New Notations London: Computer Music Processing
Maintainer/ Author: New Notations London
Last Accessed: Aug 2000

http://www.pads.ahds.ac.uk/notationEvalHomePage.html
Title: Music Notation Evaluation (our site)
Maintainer/ Author: University of Glasgow
Last Accessed: Aug 2000

http://www.susato.com/software.htm
Title:	Susato: Manufacturers, Publishers, Distributers, Dealers – Music Software
Maintainer/ Author:	Susato
Last Accessed:	Aug 2000

http://www.spindrift.com/ngabout.html
Title:	Spindrift Music Company: Nightingale
Maintainer/ Author:	Pamela J. Marshall
Last Accessed:	Aug 2000

COMPUTER AND HUMAN-COMPUTER INTERACTION SPECIFIC

http://www.acm.org
Title:	Association of Computer Machinery
Maintainer/ Author:	ACM
Last Accessed:	Aug 2000

http://www.acm.org/sigs/sigchi/cdg/cdg1.html
Title:	ACM Special Interest Group on Computer-Human Interaction: Curriculum Development Group – Curricula for Human-Computer Interaction, Chapter One: Introduction
Maintainer/ Author:	ACM
Last Accessed:	Aug 2000

http://www.acm.org/sigchi/cdg/cdg2.html
Title:	ACM Special Interest Group on Computer-Human Interaction: Curriculum Development Group – Curricula for Human-Computer Interaction, Chapter Two: Human-Computer Interaction
Maintainer/ Author:	ACM
Last Accessed:	Aug 2000

http://www.cs.cmu.edu
Title:	Carnegie Mellon: School of Computer Science
Maintainer/ Author:	Carnegie Mellon: School of Computer Science
Last Accessed:	Aug 2000

http://www.hcibib.org
Title:	HCI Bibliography: Human-Computer Interaction Resources
Maintainer/ Author:	Gary Perlman
Last Accessed:	Aug 2000

http://www.hcirn.com
Title:	Human-Computer Interaction Resource Network
Maintainer/ Author:	HCIRN
Last Accessed:	Aug 2000

http://www.ida.liu.se/labs/aslab/groups/um/hci
Title:	Human-Computer Interaction Resources on the Net
Maintainer/ Author:	Mikael Ericsson
Last Accessed:	Aug 2000

http://www.iicm.edu/
Title:	Institute for Information processing and Computer supported new Media
Maintainer/ Author:	IICM

Last Accessed: Aug 2000

http://www2.iicm.edu/hci/hci/node1.htm
Title: Institute for Information processing and Computer supported new Media**
Maintainer/ Author: IICM
Last Accessed: Aug 2000

OTHER SOURCES:

CARROLL, JOHN M, MACK, ROBERT L and KELLOG, WENDY A, 'Interface Metaphors and User Interface Design' in *Handbook of Human-Computer Interaction*, Martin Helander ed, (The Netherlands: Elsevier Science Publishers B.V.)

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ZEIGLER, JE and FAHNRICH, K-P, 'Direct Manipulation', in *Handbook of Human-Computer Interaction*, Martin Helander ed, (The Netherlands: Elsevier Science Publishers B.V.)