A Dance Education Platform for teaching Latin Dances in South Africa

James Kriel
Computer Science Honours
University of Cape Town
krljam001@myuct.ac.za

Ana Dauane
Computer Science Honours
University of Cape Town
dnxana001@myuct.ac.za

Simangaliso Mncwango
Computer Science Honours
University of Cape Town
mncsim006@myuct.ac.za

Abstract

This paper covers the proposal of a Dance Education Platform for teaching Latin Dances in a social setting in South Africa. We examine the components of the proposed platform in respect to how they will be implemented, the challenges in their creation and the evaluation procedures. Additionally, the main outcomes of the components are outlined along with the impact it is hoped that they will have on the dance community. Finally, the logistics of the project are specified in terms of the risks, milestones, deliverables and work allocation amongst the team.

CCS Concepts: • **Annotations** → Video Annotations; Audio Annotations; Annotations for Dance; • **Domain Specific Language** → DSL for Dance.

Keywords: Dance Education and Technology, Video Annotations, Audio Annotations, Domain Specific Language

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1 Introduction

As technology progresses dance educators are looking for new ways to interact with and teach their students beyond the traditional in-person classes.
This has lead to many advancements in the use of technology for Dance Education [1, 6, 8, 9, 12] over the last decade. These studies have highlighted the usefulness of technology in improving the experience and the learning capabilities for dance students [8]. Currently, there are not many mobile applications offering dance educational tools in South Africa and those that are, originate overseas and often have prices that are not feasible for the average South African citizen. In light of the pandemic and the changes to everyone's lifestyle, having access to additional technology to offer supplemental teaching and feedback from a distance has become a valuable addition to most educational disciplines, including dance. This project, conducted in partnership with Evolution Dance Studio, a Latin Dance Studio which offers lessons in the Salsa and Bachata, in Cape Town, aims to bring new technology to the South African social dance education community.
This paper proposes creating three tools to contribute to the feature set of a Dance Education Platform for Latin Dancing in South Africa. The proposed tools are a step notation system, an audio annotation tool for recognizing beats in dance music and a video annotation tool for providing feedback on student-submitted dance videos.

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2 Related Work

This section provides information on prior work done within the fields this project is being conducted and provides useful context for understanding what has come before.

2.1 Music Annotation Techniques and Tools

Computerized devices provide a digital platform and symbolic annotations provide a computerized annotation method, eliminating the use of free had text writing when doing music annotations [22]. In automatic annotation, various types of annotation present different levels of challenges in automation and it is the easiest and explicit division of audio that automatic annotation has had a huge progress success [13]. From the computational viewpoint, there is Music Information Retrieval (MIR) which support computational data search and retrieval methods implemented to music. The MIR combines different engineering methods like signal processing, informatics, machine learning, and human-computer interaction with the outcome of careful studying psychoacoustic and musicology research. MIR aims to create different successful computational algorithms for instrument recognition, temporal pattern detection, or even for music structure detection and composition. These computerized steps propel the findings and progression of the transformation and development of media collections.
Additionally, there are many research studies [4, 13, 17]

which revolve around musical annotation in a general context. Music annotations have also been explored in different aspects including the annotation of dance music and the annotation of musical scores. From an educational perspective, educators in dance schools face challenges when musical beats are not recognized by the annotation tool they are using. It has not yet been studied how audio annotation tools, which play an important role in music composition, can be utilized to recognize the music beats.

Current literature makes mention of the following algorithms for use in audio annotation for music, BeatCore and the Musical Meter Algorithm.

The operation role of BeatCore is a string of pulses that represents events on sets taken from a spectral flow differential function. The periodicities of the training function are derived utilizing Inter-Start Interval studies and are inserted into many agent systems to find the results of the beats [14]. The BeatCore operation function bypass settings include; linear frequency studies covering the whole spectrum in different analysis frames and temporal resolution [2].

The Musical Meter Algorithm will use the concept of algorithm techniques by Klapuri [10]. The analysis techniques of the musical meter algorithm combine at three-level scales. The first level scale is tatum level, followed by tactus level and the last one is measure level [14]. There are two versions of this kind of algorithm, the non-casual version and the casual version. The casual version produces audio beat rates based on previously selected beats, while the non-casual version involves finding the whole beat track utilizing back tracking.

2.2 Video Annotations for Dance Education

Video Annotations in Dance Education systems have been used for a variety of reasons. Projects such as WhoLoDancE and DanVideo [1, 9] made use of video annotations to provide a richer language with which to query dance videos in a database to improve how easily students could find specific dance pieces to learn from. The study by dos Santos et al. [3] made use of annotations to allow a dance educator to provide feedback on student-submitted videos through a web application and proved the usefulness of this feedback. The study by Lu-Ho Hsia and Gwo-Jen Hwang [8] displayed the use of annotations for university dance classes using a flipped classroom method. This study demonstrated that students who annotated videos of a dance lesson before the in-person class were able to outperform a control group in the quality of dancing they were able to learn. Only the study by Lu-Ho Hsia and Gwo-Jen Hwang [8] was implemented as both a web application and a mobile application while all the other projects were implemented as web-based applications [1, 3, 9].

A majority of the studies conducted using video annotation for dance education have developed a custom vocabulary for use in the annotation process [1, 3, 6, 9]. This vocabulary allows annotations to be grouped into broad categories with the specific feedback then entered under this label. This proved to help organize the annotations and create an easier to understand interface. Additionally, the use of custom vocabularies highlighted the necessity of implementing co-design with the dance educators who will either be using the application themselves or will be letting their students use it [3]. As an example of how the vocabularies are created, the Web-based Movement Library (WML) [6] and WhoLoDancE [1] made use of three main categories of movement descriptors which are:

- Movement Quality Descriptors
- Movement Principles Descriptors
- Action Descriptors

Based on the WML these categories were further specified as follows: The movement quality descriptors relate to movement qualities such as fluid, rigid, light etc.

The movement principles descriptors are related to Movement principles, high-level concepts that are used across all dances regardless of genre, such as symmetry, directionality, rhythmicality, coordination, etc.

The action descriptors consist of a list of basic actions such as jump, turn, step, arm gesture etc.

2.3 Domain Specific Languages and Dance

Although there are no tools for the dance representation through domain specification languages, many dance notation tools are using different dance notations, allowing the user to generate new and different versions of the dance notation through graphical representation. LabanEditor and LabanWriter [11] were created to write and edit Labanotation [5] scores graphically. Benesh Notation Editor [21], and MacBeneh [15] are dance notation graphical editors that use the Benesh Movement Notation. Unfortunately, there are no applications of domain-specific languages in the dance field. Currently, techniques such as creating dance diagrams using Scalable Vector Graphic editor [7], copy and paste and paper-based notation are used to create or edit dance steps. In terms of the DSL, Frank [18], presents the approach of the design of the DSLs, specifically the DMSLs. Smart Health Modelling Language (SHML) [16] is a domain specification modelling language that models the health ecosystems centred on the smart health domain. The Aviation Scenario Definition Language (ASDL) [20] is a domain-specific language that provides a graphic structure that defines the multiple aviation scenarios.

Overall the are many applications of the domain-specific languages because of the purpose of the domain-specific languages [19] which offers a specification language through different notation and abstractions of a particular domain.

3 Problem Statement

Currently, there are no dance education tools available to supplement traditional in-person teaching in South Africa. With the Covid19 pandemic currently engulfing the world, the need for supplemental tools to enable education at a distance has become more prevalent. Additionally, current teaching methods don't always take into account people's schedules, different learning styles and offering easy access to furthering your education alone. These are all pursuits that are common to many educational disciplines and dance is no different.

Today, dance education platforms do exist but most are offered from overseas companies and are thus too expensive for the average South African to afford and are a one-way experience, offering only videos of the teachers which the student can learn from without any way for the student to get feedback from the teacher or test their knowledge about the theory of the dances. There are currently limited methods to help a novice learn the timing and counts of the music and there are none that can automatically identify the counts for any arbitrary song of the Latin style. Lastly, there are no tools available to visualize and construct dance steps using a step notation language allowing students to construct and see steps play out for themselves to aid in learning.

The project aims to develop a dance education platform for teaching Latin Dances, specifically Salsa and Bachata, for South Africans which will focus on three specific areas as detailed below:

- A step notation tool which will provide a space where novice and expert users can create and edit dance steps for dance learning and dance documentation purposes in the simplest way developed by Ana Dauane
- An audio annotation tool which will be developed to investigate the algorithms of current music annotation tools and draw comparisons between them so that the music annotation algorithms can be analyzed and improved developed by Simangaliso Mncwango
- A video annotation tool which will allow a dance educator to provide feedback using a custom annotation vocabulary on student-submitted dance videos to encourage improvement outside of the classroom and a possible extension to allow students to annotate professional videos with or without mistakes to gain a deeper understanding of the technique developed by James Kriel

The Video Annotation tool will be undertaken as a software development project discussed in Section 3.2 while the music annotation tool and domain-specific language will be undertaken as a research project with the research objectives addressed in Section 3.1.

3.1 Research Objectives

The research objectives for the step notation tool are as follows:

- Suitability of the graphical language
- Investigation of possible usability evaluation methods from the HCI-context that are used on graphical notation systems of process modelling methods

By fulfilling these objectives, we believe that the tool's outcome is of higher graphical correctness in the tool and higher editor usability relating to basic controls for the notation elements and properties. In addition to that, we intend to have a tool that involves a low level of effort relating to time and approach when producing the DSL and the analysis capabilities for the transformation models with the graphical editor.

The research objectives for the audio annotation tool are as follows:

- How music annotation algorithms can be utilized for beat recognition in salsa songs
- How music annotation algorithms can be useful in the identification of counts for dance in music

The main goal is to investigate the hypothesis which says the algorithms for beat recognition in popular music like pop songs work equally well for salsa songs. This will address efficiently how algorithms for beat recognition in pop songs can work the same as in salsa songs. This is motivated by the fact that Klapuri's algorithms [2] which is the beat tracking algorithm worked well in pop song to recognize its beat.

3.2 Software Development Details

This project aims to produce a tool that can be used to supplement social dance education in South Africa. As that is quite a broad field the primary focus is on the dance studio, Evolution Dance, and the dances that it teaches being Salsa and Bachata.

The primary target users will be the dance educators as first and foremost this project is about creating a tool to allow dance educators to give feedback to student-submitted videos. A secondary target user group would be the dance students by creating a tool allowing students to test their knowledge of the dances by annotating professional video lessons similar to the study by Lu-Ho Hsia and Gwo-Jen Hwang [8].

The requirements of a video annotation system for feedback are:

- Custom Dance Instructor Annotation Vocabulary
- Navigation interface to go between videos
- Ability to traverse a video by the annotations
- Ability to add annotations

- Ability to edit annotations
- Ability to delete annotations

while the requirements for student self-learning are:

- Custom Dance Instructor Annotation Vocabulary
- Navigation interface to go between videos
- Ability to traverse a video by the annotations
- Ability to edit annotations
- Database of pre-annotated dance videos
- Interface to select the correct annotation choice from a list of options

4 Procedures and Methods

Due to the separate nature of the three tools, their procedures will be mostly discussed independently from one another. The one exception for procedures that will be shared will be regular meetings with Dance Educators from Evolution Dance Studios for co-design, resource acquisition and additional requirement gathering.

4.1 Step Notation Tool

Firstly, we will focus on the components that create a domain-specific language. We will analyze the different ways a DSL can be designed. In this case, we will use the domain-specific modelling languages (DSML) and how they can be applied for the salsa dance. The use of DSML will allow the user to represent the step notations graphically. The notations techniques are focus more on which tools can be used to create and edit the dance steps. The notation will be computed graphically in illustrated salsa dance steps allowing the user to input the dance steps graphically. The Step Notation will be implemented using Frank's [18] design approach for the domain-specific modelling languages (DSML) using a three-phase development approach for this project. The first phase will be defining an abstract syntax, followed by the design of concrete syntax. Finally, the third phase will develop a modelling tool and evaluation. The phases will be explained as follows:

- *Abstract Syntax*. The abstract syntax [16] will be defined by the fundamental components of the language, their dependencies and equivalent modelling rules of the salsa dance steps in the structure of a metamodel.
- *Concrete Syntax*. To make the concepts of the abstract syntax, the metamodel of the abstract syntax will be covered into a concrete syntax which will be designed into graphical notations.
- *Development and Evaluation.* The final step is to apply the developed DSML into the salsa dance context, resulting in a domain-specific modelling language that models the salsa dance steps. The evaluation is to ensure the quality levels of the DSML by considering the metamodel and the notation. The evaluation regarding the notation and metamodel will be to discover if the user has preferences of graphical notations, if the tool has sufficient description of the basic steps for beginners level and the level of difficulty when using the tool. A set of questions will be performed to get an insight and general feedback of the users towards the tool.

4.2 Audio Annotation Tool

Firstly, we aim to study the beat tracking algorithm by Klapuri [2]. We will spend time in analyzing the algorithm to find more about it in terms of design. The beat tracking algorithm will be analyzed based on its performance in pop songs in terms of how does it worked to identify beats in pop songs.
After understanding its operation and its functionality, we will then apply it into any salsa song. We will then make comparison between salsa songs and pop songs. Results will be generated in terms of how the beat tracking algorithm were able to work in pop songs and in salsa songs

4.2.1 Evaluation. We will evaluate it based on the ability to recognize beats in pop songs and in salsa songs. We assume that the beat tracking algorithm will work equal in pop songs for beat recognition as in salsa songs. This is how we are going to measure its success.

4.3 Video Annotation Tool

This section will detail the process for creating the Video Annotation tool with Section 4.3.1 detailing the design features, the design methodology and the language and tools to be used. Section 4.3.2 covers possible issues that may arise during development. Lastly, Section 4.3.3 details how the evaluation of the Video Annotation tool will be conducted.

4.3.1 Implementation Strategy. The main features of the video annotation tool will be the ability to playback a video, annotate a video, edit annotations, delete annotations, save annotations, navigate videos by the existing annotations and navigate through all videos in the database.

The video annotation tool will be developed using an iterative design methodology. This methodology was chosen as the application is meant to be of use to non-computer experts and thus ensuring that it is always meeting the requirements of the intended users is of the utmost importance. As such the tool will be subject to slight redesigns based on mid-development feedback from the dance educators at preset feedback sessions which will be decided during the course of the project.
The video playback and navigating through all videos in the database will be developed in the first iteration, followed by the development of annotation creation and storage. Finally, the editing, deleting and viewing of annotations will be completed.

The mobile annotation application will be developed using

Java as an Android application. Java was chosen due to personal preference and prior knowledge of the platform. While it would be best to be able to build the platform on both iOS and Android devices that is not feasible in the time frame and since Android Studio runs on Java it makes more sense to develop on Android. Additionally, libraries such as Simple XML for handling the storage and manipulation of the annotation files are fully compatible with Java and increase the motivation to make use of the language.

4.3.2 Expected Challenges. Despite prior experience in Java, challenges are expected to arise from the need to learn to work with technologies without any prior experience. These technologies are as follows:

- MPEG-7 Format
- XML Storage and Manipulation
- Video Playback within Java

Time at the beginning of the development process will be allotted for learning these technologies before development on the tool itself begins in earnest.
Additional challenges that are beyond personal control will be brought up as part of the Risk Matrix in Appendix A.

4.3.3 Evaluation. An evaluation will be conducted to assess the effectiveness of the final video annotation tool. The participants will be recruited from the dance teachers with whom this system is being designed. The evaluations results will be composed of qualitative feedback on the application in the form of long, open-ended questions while the use of the Likert scale will give a usable form of quantitative data despite this being a subjective study. The evaluations will comprise of three different sections:

- Time for the user to experiment with the prototype without assistance
- A set of tasks for the user to perform
- A post-evaluation interview and questionnaire using long-form questions and the Likert scale

The user experimentation time will be used to simulate a user having just downloaded an app off their phone and exploring it themselves to see how discoverable the features of the video annotation tool are.
The task list will be used to test specific features of the annotation tool, both to ensure that the user can work out how to perform them and ensure that the application works to their specifications.
The post-evaluation questionnaire will be used to gain an insight into the user's experience using the application with the use of long-form questions allowing the user to give their detailed thoughts on the tool.
Additionally, the users will be asked to speak aloud while they make use of the application in both the exploration and task sections to provide a transcript that can be analysed for qualitative responses indicating how the experience of using the application was in the moment.

Smaller-scale evaluations will be conducted following a similar structure throughout development to gain feedback on the progress of the tool's development and to support the iterative development cycle.
The final evaluation will be used to provide the results of the project which will appear within the academic paper.

5 Ethical, Professional and Legal Issues

There are no professional issues as we do not plan to copyright any of the code we write.
Legal issues from copyrighted music will be avoided by ensuring that the music is royalty-free and by requesting input on music from Evolution Dance Studio. Similarly, the video annotation tool will make use of self-made videos and videos provided by Evolution Dance Studio.
The video annotation tool and step notation tool do present an ethical issue as they will require user testing to evaluate. This will require ethical clearance to proceed with but, it should not be a problem as user tests pose very little risk to any user involved because the evaluation of the tool will not involve any attempts at human behaviour modification and the participants involved will not be at risk individuals such as pregnant woman, children or disabled persons.

6 Anticipated Outcomes

6.1 System

Our final system will consist of three tools that form the basis of a Dance Education platform.

6.1.1 Step Notation Tool. The key features of the step notation tool are the graphical representation of the steps, the design component that allows users to set up a sequence of dance steps using the notation and the limitation for only representing the salsa dance notation and its constraints.

6.1.2 Audio Annotation Tool. The anticipated outcome of development will be an audio annotation tool that will be useful in the identification of the counts for dance in music. The system will demonstrate the beats recognition by an annotation tool to support huge social dance classes and music in educational schools in South Africa.

6.1.3 Video Annotation Tool. The expected outcome for the video annotation tool will be a graphical user interface to allow a dance educator to annotate student-submitted videos and provide feedback using a custom annotation vocabulary. Additionally, time permitting, the outcome will include a video annotation tool for students to annotate professional dance videos, either with mistakes or without, from a selection of pre-defined possible annotation options to test their knowledge of the theory behind the dances.

6.2 Impact

We expect the impact of the project to be the components of a dance education platform that can be used to improve and supplement the existing in-person learning experience of Latin Dance in a social context in South Africa by providing new ways for a student to learn to recognize the timing of a dance, learn the steps by being able to create and edit dance steps visually and be encouraged to continue practising at home knowing they can still receive feedback easily from their educators.

6.3 Key Success Factors

Successfully proving the better algorithm for use in beats recognition for Latin dancing will result in success for the audio annotation tool while positive results of the user evaluations in regards to ease of use and the extent to which user requirements are met will provide the notion of success for the step notation and video annotation tool.

7 Project Plan

7.1 Risks

This project is subject to multiple risks, many because it is a combination of both a software development project and a research project. Additionally, the presence of Covid-19 amplifies many of the existing risks. The risks will be clearly defined within the Risk Matrix in Appendix A.

7.2 Timeline

The timeline of the project is from 3 May to 18 October 2021 when the final project component is submitted. The deadlines of components of the project along with specific milestones are displayed within the Gantt Chart in Appendix B.

7.3 Resources Required

We will make use of our personal computers and an appropriate IDE (Visual Studio, IntelliJ or any other) for building our respective tools for the education platform.
Additionally, the data required for the audio annotation tool and the video annotation tool, being music tracks and professional as well as student dance videos respectively, will be sourced with help from our project supervisor and the Evolution Dance Studio.

7.4 Deliverables

The final deliverable of this project is an academic paper and the accompanying code for each of the experiments and software development projects outlined in the previous sections. Several other deliverables created during the course of the project will also contribute to the final deliverable and are displayed below:

- A literature review for each aspect of the project
- A project proposal
- A draft of the academic paper
- The final academic paper
- The source code for each members contribution
- A poster and website containing information about the project

7.5 Milestones

We have several milestones for the duration of this project which will be specified in the Gantt chart in Appendix B. Many of the milestones appear as Deliverables listed in Section 7.4. The remaining milestones are defined by significant points in the development of the project such as the completion of code segments and the completion of user tests and phases of self-testing. Some of the bigger milestones include:

- Completion of the Project Proposal
- Completion of Pre-Development Research
- Implementation of code base
- Completion of Experiments/Evaluations
- First Draft of Final Paper
- Final Paper Submission

7.6 Work Allocation

The entire group will collaborate on shared deliverables such as the poster and website.
The three tools themselves are allocated to one group member each. The step notation tool's development and testing will be conducted by Ana Dauane, Simanagaliso Mncwango will develop and test the audio annotations for recognizing music beats and the video annotation tool for educator feedback will be developed and user-tested by James Kriel.

References

[1] Rosemary E. Cisneros, Kathryn Stamp, Sarah Whatley, and Karen Wood. 2019. WhoLoDancE: digital tools and the dance learning environment. *Research in Dance Education* (2019), 54–72. https://doi.org/10.1080/14647893.2019.1566305

[2] Simon Dixon. 2007. Evaluation of the audio beat tracking system beatroot. *Journal of New Music Research* 36, 1 (2007), 39–50.

[3] Augusto dos Santos, Lian Loke, and Roberto Martinez-Maldonado. 2018. Exploring Video Annotation as a Tool to Support Dance Teaching. In *Proceedings of the 30th Australian Conference on Computer-Human Interaction*. ACM, 448–452.

[4] Bryan Duggan, Brendan O'Shea, Mikel Gainza, and Padraig Cunningham. 2009. The annotation of traditional Irish dance music using MATT2 and TANSEY. *annotation* 2009 (2009), 01–01.

[5] Katerina El Raheb and Yannis Ioannidis. 2014. From Dance Notation to Conceptual Models: A Multilayer Approach. In *Proceedings of the 2014 International Workshop on Movement and Computing*. ACM, New York, NY, USA.

[6] Katerina El Raheb, Aristotelis Kasomoulis, Akrivi Katifori, Marianna Rezkalla, and Yannis Ioannidis. 2018. A Web-Based System for Annotation of Dance Multimodal Recordings by Dance Practitioners and Experts. In *Proceedings of the 5th International Conference on Movement and Computing*. ACM, 1–8. https://doi.org/10.1145/3212721.3212722

[7] FANDOM. [n.d.]. *Creating dance diagram.* https://swing.fandom.com/wiki/Creating_dance_diagrams

[8] Lu-Ho Hsia and Gwo-Jen Hwang. 2020. From Reflective Thinking to Learning Engagement Awareness: A Reflective Thinking Promoting Approach to Improve Students' Dance Performance, Self-efficacy and Task Load in Flipped Learning. *British Journal of Educational Technology* 51, 6 (2020), 2461–2477. https://doi.org/10.1111/bjet.12911

[9] Rajkumar Kannan, Frederic Andres, and Christian Guetl. 2010. DanVideo: An MPEG-7 Authoring and Retrieval System for Dance Videos. *Multimedia Tools and Applications* 46, 2 (2010), 545–572. https://doi.org/10.1007/s11042-009-0388-3

[10] Anssi P Klapuri, Antti J Eronen, and Jaakko T Astola. 2005. Analysis of the meter of acoustic musical signals. 14, 1 (2005), 342–355.

[11] K. Kojima, Kozaburo Hachimura, and Minako Nakamura. 2002. Exploring Video Annotation as a Tool to Support Dance Teaching. In *Proceedings of the 11th IEEE International Workshop on Robot and Human Interactive Communication*, Vol. 11. IEEE, 59–64.

[12] Pieter-Jan Maes, Denis Amelynck, and Marc Leman. 2012. Dance-the-Music: An Educational Platform for the Modeling, Recognition and Audiovisual Monitoring of Dance Steps Using Spatiotemporal Motion Templates. *EURASIP Journal on Advances in Signal Processing* 2012, 1 (2012), 1–16. https://doi.org/10.1186/1687-6180-2012-35

[13] Alan Marsden, Adrian Mackenzie, Adam Lindsay, Harriet Nock, John Coleman, and Greg Kochanski. 2007. Tools for searching, annotation and analysis of speech, music, film and video—a survey. *Literary and linguistic computing* 22, 4 (2007), 469–488.

[14] Martin F McKinney, Dirk Moelants, Matthew EP Davies, and Anssi Klapuri. 2007. Evaluation of audio beat tracking and music tempo extraction algorithms. *Journal of New Music Research* 36, 1 (2007), 1–16.

[15] J.C. Singh, B.and Beatty and R Ryman. 2002. Exploring Video Annotation as a Tool to Support Dance Teaching. In *A graphics editor for benesh movement notation*, Vol. 10. SIGGRAPH 83, 59–64.

[16] Gero Strobel. 2021. Health in the Era of the Internet of Things: A Domain-Specific Modelling Language. In *Proceedings of the 54th Hawaii International Conference on System Sciences*, Vol. 54. HISCC, 3705–3012.

[17] Derek Tingle, Youngmoo E. Kim, and Douglas Turnbull. 2010. Exploring Automatic Music Annotation with "Acoustically-Objective" Tags. Association for Computing Machinery, New York, NY, USA. https://doi.org/10.1145/1743384.1743400

[18] Frank Ulrich. 2013. Domain-Specific Modeling Languages: Requirements Analysis and DesignGuidelines. *Domain Engineering* (2013), 133–157. https://doi.org/10.1007/978-3-642-36654-3_6

[19] A. Van Deursen, P. Klint, and J. Visser. 2000. Domain- specific languages: an annotated bibliography. In *ACM Sigplan Notices*, Vol. 6. ACM, 26–36.

[20] A. Van Deursen, P. Klint, and J. Visser. 2017. Graphical Specification of Flight Scenarios with Aviation Scenario Definition Language (ASDL). In *AIAA Modeling and Simulation Technologies Conferences*. AIAA SciTech Forum, 26–36.

[21] Victoria Watts. 2015. Benesh Movement Notation and Labanotation: From Inception to Establishment (1919-1977). *Dance Chronicle* 38, 3 (2015), 275–304. https://doi.org/10.1080/01472526.2015.1085227

[22] M. Winget. 2006. Annotation of musical scores: Interaction and use behaviours of performing musicians. https://doi.org/10.17615/szx7-6h77

8 Appendix A - Risk Matrix

Risk	Probability	Impact	Consequence	Mitigation	Management
Lack of stakeholder engagement	6	5	Impede the degree to which the software development aspects of the work can be made to meet the stakeholders needs.	Hold meetings to determine requirements and needs of the stakeholders as early in development as possible.	Consult with the project supervisor and identify if other dance educators exist with whom we could meet.
Not meeting the needs of the users	3	6	The end product will not meet the user's needs and will be unlikely to be used and further developed as a viable project.	Regular meetings with the users and an iterative development cycle to encourage user involvement.	Continue with the testing as if this were what was requested to ensure the results are collected regardless of their positive or negative outcomes.
Team member dropping out.	4	4	There would be an increase in workload on the shared components required for the end of the project.	Take Covid19 precautions and work remotely.	Exclude the member's contribution to the final shared hand-ins and redistribute that member's contribution to the shared hand-ins amongst the remaining members.
Unable to perform user tests (probability increased due to Covid)	5	8	The Video annotation and step notation tools would not have the results needed to complete the project.	Take Covid19 precautions and investigate alternative distance methods to perform the tests.	Consult with the project supervisor and attempt to redefine the test questions to be done without user involvement or use crowd sourcing to find participants.
Losing progress on code development and final academic paper due to technical failure.	5	9	The project will be significantly disrupted and work that was only saved to the local machine will be lost.	Make use of online repositories such as GitHub and Google Drive to ensure backup copies of work exists.	Restart the project on a newly sourced computer borrowed from friends or family.
Scope Creep	6	6	The workload may become impossible to complete within the projects timeframe and result in core features being excluded.	Regular consultation with the project supervisor and strict adherence to the originally decided upon scope.	Redefine the scope of the section and determine which features are most important for the final deliverable.
Supervisor unable to continue with the project	3	10	The project will lose its supervisor and so a new supervisor will have to be found which may change the objectives of the project.	Keep regular contact with the supervisor to be given sufficient warning time should this occur.	Discuss an alternate supervisor to take over the project with the current supervisor and get guidance from the new supervisor for the future of the project.

9 Appendix B - Gantt Chart

SALSA

Read-only view, generated on 24 Jun 2021

Instaga

	ACTIVITIES	ASSIGNEE	EH	START	DUE	%
	Literature Review:		-	17/May	04/Jun	100%
1	Literature Review	AD, JK, SM	-	17/May	04/Jun	100%
	Project Proposal:		-	17/May	30/Jul	2%
3	Project Proposal Due	AD, JK, SM	-	17/May	24/Jun	0%
4	First Draft completed	AD, JK, SM	-	15/Jun	15/Jun	100%
5	Review Feedback and Refin...	AD, JK, SM	-	19/Jul	30/Jul	0%
6	Create Project Presentation	AD, JK, SM	-	01/Jul	06/Jul	0%
7	Upload Proposal Presentati...	JK, AD, SM	-	09/Jul	09/Jul	0%
8	Ethics Application Due	AD, JK, SM	-	12/Jul	12/Jul	0%
	Pre-Development Tasks:		-	09/Jul	16/Jul	0%
10	Testing new technologies	AD, JK, SM	-	09/Jul	16/Jul	0%
11	Completion of testing new t...	AD, JK, SM	-	16/Jul	16/Jul	0%
	Tools Development:		-	16/Jul	20/Sep	0%
13	Video Playback	James Kriel	-	16/Jul	20/Jul	0%
14	Multiple video navigation	James Kriel	-	20/Jul	26/Jul	0%
15	Annotation Creation and St...	James Kriel	-	26/Jul	31/Jul	0%
16	Annotation Editing, Deletion...	James Kriel	-	31/Jul	12/Aug	0%
17	Build Domain Metamodel	Ana Dauane	-	19/Jul	23/Jul	0%
18	Generate Code for the DSL	Ana Dauane	-	23/Jul	13/Aug	0%
19	First Version of the Step Not...	Ana Dauane	-	15/Aug	15/Aug	0%
20	Project Code Submission	AD, JK, SM	-	20/Sep	20/Sep	0%
21	Annotation Algorithm Analy...	Simangaliso Mn...	-	19/Jul	26/Jul	0%
	Evaluations:		-	15/Aug	31/Aug	0%
23	First DSL tested	Ana Dauane	-	15/Aug	15/Aug	0%
24	User Evaluation	AD, JK	-	23/Aug	26/Aug	0%
25	User Evaluation Results Coll...	AD, JK	-	26/Aug	28/Aug	0%
26	Algorithms Experiment	Simangaliso Mn...	-	24/Aug	31/Aug	0%
	Project Paper:		-	10/Jul	17/Sep	0%
28	Paper Scaffold Write-up	AD, JK, SM	-	10/Jul	06/Aug	0%
29	Paper Scaffold Due	AD, JK, SM	-	06/Aug	06/Aug	0%
30	Background Write-up	AD, JK, SM	-	08/Aug	14/Aug	0%
31	Initial Software Feasibility Pr...	AD, JK, SM	-	13/Aug	13/Aug	0%
32	Implementation/Testing Wri...	AD, JK, SM	-	17/Aug	26/Aug	0%
33	Project Weighting Decided	AD, JK, SM	-	30/Aug	30/Aug	0%
34	Results Analysis	AD, JK, SM	-	05/Sep	05/Sep	0%
35	Final Draft Completed	AD, JK, SM	-	06/Sep	06/Sep	0%
36	Review Feedback and Refine	AD, JK, SM	-	06/Sep	17/Sep	0%
37	Project Paper Final Submiss...	AD, JK, SM	-	17/Sep	17/Sep	0%
	Post Project Paper:		-	20/Sep	18/Oct	0%
39	Demo Preparation	AD, JK, SM	-	20/Sep	04/Oct	0%
40	Final Demo	AD, JK, SM	-	04/Oct	04/Oct	0%
41	Create Project Poster	AD, JK, SM	-	20/Sep	11/Oct	0%
42	Poster Due	AD, JK, SM	-	11/Oct	11/Oct	0%
43	Create Project Web Page	AD, JK, SM	-	12/Oct	17/Oct	0%
44	Project Web Page Due	AD, JK, SM	-	18/Oct	18/Oct	0%