DancePro

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Introduction/Summary

DancePro is a fun console based dance teaching game. The game uses special hardware input devices (such as gloves and shoes) to motion capture players' dance moves. Users create 3D avatars and take virtual dance classes and compete in competitions where they learn dances such as salsa, tango, swing, bachata, hip hop, and other types of dances. The game provides couple based as well as individual based classes. Users can also unlock various content-based on their performance in the game. The types of content the learners can unlock are new challenges and game modes that teach them new moves.

Description of your learners

-*Who are they?*
Our software will include various difficulty modes in different dance categories for beginner, novice, recreational, and more advanced dancers. Any learner with cognitive ability to remember the dance steps and map the steps given through DancePro to their own feet and hands will be able to use DancePro. Many couples will enjoy using DancePro as the software provides lessons in couples dancing. Most people avoid dancing because they have never learned how to dance. While there are dance lessons offered in almost every city, they are often too expensive or unworthy. For instance, some dance classes have over a hundred people in a lesson. With so many people in a class, the instructors rarely address individual mechanical problems. DancePro provides individual attention to its users by providing feedback based on the users' movements.

- *How old are they?*

The learners of DancePro are diverse in terms of age. Dancing attracts all ages and all backgrounds. However, the users of our system will typically be young adults.

- *What interests do they have?*

The learners have an interest to learn how to dance various dances by themselves or with a partner in a fun and engaging way and potentially use them in the real world.

Description of the Learning Environment

-*Where do you expect your learners to be using this?*
The learning environment is in the form of recreational game. The game is accessed through a game console machine. With the use of foot and hand sensors to monitor their movements, learners will learn how to mimic dance routines and steps from a television screen connected to the console.

Consequently, this system will most likely be used at home. Up to two people can use DancePro at the same time as the two can participate in couples dancing. An individual can also participate in singles dancing (i.e. footwork, body movement)

- *Who are the other people you expect to be present while learners are using your software? Think about how they may play a role in helping your learner learn.*

DancePro can be used individually or with another person (couples dancing). The other people expected to be present would be family members or friends. These people would play a role in the learning experience because they would visually see the learner performing the moves and be likely to give feedback. Just like Dance Dance Revolution or Rock Band, people in the room often encourage or give advice to the users of the software.

Description of what you want your learners to learn. Some of you have already done a good job of this. Some of you have not been specific about this yet. Be specific about skills you want them to learn and content.

DancePro teaches learners how to Dance various dances by themselves or with a partner. Learners learn some cultural and musical aspects of each dance style as well as the different rhythms. DancePro also teaches lead dancers how to lead as well as followers how to follow. Finally, DancePro teaches the context of moves and why they are performed or lead in a certain way.

Rather than have the learners just learn basic steps or where to place steps, DancePro will teach learners why certain steps or motions are done. For example, in Bachata dancing (a Latin style couples-dance), the leader needs to lead with their body rather. DancePro teaches the context of why moves are learned (for example, a basic turn in Bachata is critical for later lessons, and DancePro will explain this).

What makes learning these things difficult? What difficulties might your learners have along the way in really learning well what you want them to learn?

What will be difficult for our learners is that they will need to model themselves after the avatars. Since the avatars appear on the screen and the learners are watching the avatars perform, the learners have to map the movements to the real world; this task is not easy. Our teaching tool will use technology to help address this learning difficulty. Our virtual avatars will highlight different sections of the body as they reference them in the lesson. For example, the avatar instructor will model a move for the learner and highlight their arms or legs as they perform the move depending on what body part is being used.

Another difficulty in learning to dance is leading and following in couples's dances. DancePro explains how and why certain moves are lead in certain ways for leaders and how followers determine how to follow a move. For example, hand movements for a leader are very important to signal to the follower; additionally, a follower needs to know what hand movements to look out for. DancePro will explain these hand motions as well as why the hand motions are done in order to convey a signal to the follower.

Lastly, many people do not find learning to dance engaging or interesting. Frustration in not getting steps down correctly at first can dissuade learners from continuing to learn how to dance.

Framework for your design solution

-Constructionist?
The virtual cups and competitions offer some constructionist aspects as the learner learns how to improvise dance based on a simulated real world experience. Additionally, the reason learners use DancePro is to learn how to dance in the real world. However, our educational approach is not directly toward constructionist and more toward the apprenticeship/tutoring side.
Learners will take the dance moves they learned using DancePro and apply it to the real world. While there is no substitute for actually going out and dancing in front of people, knowing the fundamentals of different dances is an advantage.

- *Cognitive tutors?*

There are elements of this educational approach in DancePro as the instructors teach why a certain move was performed by the learner in a correct or incorrect way.

- *Cognitive apprenticeship?*

DancePro's educational approach is cognitive apprenticeship. The learners take the role of an apprentice learning from a mentor that models a move then coaches and scaffolds the apprentice.

- *Goal-Based Scenarios?*

Career mode is a goal based mode in which the learner's goal is to become a world renowned dancer. Additionally, every virtual lesson that a user takes has goals (learn a dance move, body movement, posture, etc). The goal of a lesson is to learn a new move.

- *Knowledge building?*

Our system doesn't really rely on inquiring from the learner to learn how to dance. This is a drawback to real life dance classes in which questions can be asked. DancePro will have a little bit of knowledge building as the user can choose the dance style and level to learn as well. However, there is no question and answer with DancePro. DancePro attempts to figure out what the learner is doing wrong rather than require input from the learner.

- *How are you applying this approach? If you are combining more than one, how are you combining them? Why?*

Our educational approach is primarily cognitive apprenticeship and goal-based scenarios. The couple using the system views the avatar instructors model a move then performs the move themselves. There are some cognitive tutoring aspects (although our system is primarily cognitive apprenticeship) as DancePro explain why moves were performed incorrectly/correctly. If a leader in a couples dance leads a move incorrectly, the avatar explains why the learner did something wrong (i.e."Your steps were wrong because you didn't shift your weight to your right foot after the first step.")

But as mentioned, since our system doesn't focus primarily on thought process, DancePro is classified in the cognitive apprenticeship realm. The cognitive apprenticeship for our system can be seen in a Salsa example. Two users participate in a Salsa "class" and are shown how to do a cross-body lead with an inside turn. If the female user performs an outside turn rather than an inside turn, the instructor avatar will approach the users' avatars (represented also as 3D characters) and explain what went wrong (either the male led the move incorrectly or the female simply turned the wrong way). Based on information from the hardware peripherals, the couples' avatars can replay the human couple's movements in the 3D world acting as a virtual mirror to the users' actions. The instructors will deliver coaching and scaffolding depending on the performance of the learners.

There are also multiple goal-scenarios in DancePro. The Career Mode is a Goal-Based game mode where the user's goal is to become a "world renowned dancer."

While DancePro features "virtual dance cups" and competitions that learners can participate in that have no instructor or set of rules, DancePro doesn't rely on the learners undergoing the experiences to learn how to dance. Consequently, the constructionist framework is not a major component to DancePro. DancePro focuses on teaching by modeling rather than experience as real world evidence has shown that students learn dances better by instruction rather than self-induced experience. The dance cup is an opportunity to practice and assess their experiences from the classroom. However, one can argue that there is constructionist in the dance cups as the dance cups require experience in things no teacher can teach such as improvisation. In order to build that mental model one must either practice in the dance cups or in the real world dance clubs.

In summary, DancePro turns out to be a system that has a primary framework in cognitive apprenticeship but features different attributes from other frameworks as well. Our framework includes goal-based missions and virtual classes (cognitive apprenticeship) with avatar instructors that point out thought processes to the learner (cognitive tutoring). Additionally, DancePro's virtual cups and competitions produce an environment where learners can examine what they did right or wrong and learn based on experience (constructionist).

Why DancePro chooses cognitive apprenticeship to be the primary framework is because cognitive apprenticeship is how real world instructors typically model their classes. Dancing is best learned from an instructor with scaffolding. "First and foremost, apprenticeship focuses closely on the specific methods for carrying out tasks in a domain. Apprentices learn these methods through a combination of what Lave calls observation, coaching, and practice, or what we, from the teacher's point of view, call modeling, coaching, and fading. In this sequence of activities, the apprentice repeatedly observes the master executing (or modeling) the target process, which usually involves some different but interrelated sub-skills. The apprentice then attempts to execute the process with guidance and help, from the master."" (Knowing, Learning, and Instruction)

- *Within this framework, how will you engage your learners?*

DancePro is designed in a way that makes the user want to proceed through the lessons learning new dance moves while competing in cups and gaining more extras of the game and for their avatar.

The main draw will be the "Career Mode" which will have the users create an avatar that they will take across the world learning different dances and competing in cups to win prizes and titles. In each part of the world there will be a different kind of dance to learn along with different clubs and teachers. This has some similarities with Whyville which lets the learners explore the space around them and pick out what they want to learn about. In Career Mode, the learner explores different areas of the world and their dances. There is a set of lessons and competitions/cups for the user at each location. Progressing through these locations, the user slowly builds experience points. With enough points, the learners become the best dancer in the world. The prizes will be different things like money to buy customizations for their avatar, new challenges such as bonus cups, and new bonus dance lessons.

Cups/Competitions
In cups and competitions, learners perform (as a couple or individually) at "dance clubs" which feature computer opponents (or human components in online mode). The environment is a club like environment with colorful lights and music for the style of dance. The learners have the length of the song to perform dance moves learned in DancePro in that style of dance in the club. Points are given depending on how accurate the move is performed and the difficulty/frequency of the move. Through this mode learners will learn how to improvise dance moves.

As an incentive to perform well in Career Mode, "Quick Play" mode allows the user to perform in any cup that has already been completed/unlocked through career mode. These cups will be for high scores.

Learners can also play an online mode quick play mode where the avatars they compete with are other human users from around the world (more experienced will compete with more experienced and vice versa). These online clubs will have a large capacity to simulate a real club with lots of dancers. The best dancers of the song will appear at the end and rewarded with points.

The "Lessons" in the game will try to mimic real world lessons. A 3D avatar will appear and the user will see the avatar in a dance room. Just like in regular lessons, users will be required to perform basic steps before moving on to complex patterns. At the end of each lesson, there is an assessment where the user(s) will be required to perform the steps or patterns learned.

Not only will the virtual world be entertaining (as users are able to customize their avatars), but the virtual world gives many affordances that a human world doesn't. For one, the replay playback can slow down time and the 3D camera can actually zoom onto the part of the move (or the avatar) that was performed incorrectly. Features like this help let the learners see how the dancing works on more levels than normal. Much like Genoscope which let the learners see what was going on from many different points of views. These features engage learners especially well since they cannot receive this type of feedback in traditional classes.

Rather than move into a simulation environment when a move is performed incorrectly, our learners will, just like in the real world, receive feedback in the "classroom." There will also be other virtual avatars/couples in the class performing the move (these are computer controlled) in order to give the sense that it is a class rather than a private lesson.

- *Given this framework, what component parts does your design need to have?*

What special technology elements are you using? Any special hardware? Any specialized software?
Special hardware will be used to detect body movements of the user. This current initial design will list a few unique yet possible input devices that learners will use while using DancePro. Based on feedback an appropriate input device will be selected for the final design.

The first input device pack is two shoes and two gloves.

These gloves and shoes have sensors embedded inside them that the console communicates with to determine the position, orientation, and gestures of the players' feet and hands.

The second input device pack is similar to the above idea with sensors, but socks instead of shoes.

With socks, the user can use their own dance shoes. A negative side of using socks is that socks may not be able to detect which foot has body weight. With shoes, sensors can be placed underneath the shoes. However, socks won't really be able to have sensors anywhere under the sock as that could be discomforting to the user. Another idea would be shoe inserts.

The problem with gloves is that they are typically uncomfortable and that may hinder the learning experience in couple dancing. Consequently, a third input device pack idea is using a wrist bracelet. An ankle bracelet is also a consideration however the orientation of the feet may be difficult to calibrate.

A con of wrist bracelet is that hand and finger positions will be impossible to determine. Many couple dancing requires specific hand positions in order to facilitate/support turns of the female.

The goal of the input devices is to provide the system with enough information that can be used to give specific feedback to the user. However, as mentioned above, there is a trade off in comfort and ability.

Obviously, there are other combinations and ideas for input than of those listed above; however, the method of input is not a focus of this design. DancePro’s hardware in this theoretical design is assumed to give sufficient input to the program to analyze the learners’ motions.

- *Within this framework, how will you be able to address the difficulties you identified above?*

- Motivation to Learn: While seen as entertaining, dancing is also an art form. It allows people who incorporate this medium to express themselves through physical feats and movements paralleling the tone and beat of the music they are dancing to. Also, dancing provides a good workout; a great deal of movement from various parts of the body is required resulting in a full body workout. It also builds muscle memory and trains different memory skills in the brain. DancePro itself is designed in a way that even if the users are not that interested in learning different dances they will still have fun learning through the career mode and competition with other players. Since DancePro offers a multitude of dance style selections, learners choose to learn dances that match personal tastes and have a higher chance of continuing to learn because they are dancing in a style they enjoy.

  To create an environment that learners will want to grow and expand their dancing knowledge in, DancePro creates scenarios that get the learners personally involved with the career mode. The learners get personally invested with their onscreen avatar putting their own passions and personality into the 3d model. It is important that learners connect their passion, interests and experiences to learning new dances and enjoying themselves. "When activities involve objects and actions that are familiar, users can draw on their previous knowledge, connecting new ideas to their pre-existing intuitions." (Pianos not Stereos). Consequently, DancePro attempts to add authenticity and personalization to the game. Learners can customize their avatars to the height and weight to their body type to have the avatar reflect their image. This virtual-real mapping of appearance is critical to learning to dance as the learner can interpret their moves better. Additionally, to add some authenticity, DancePro instructional avatars will have voice accents from their style of dance's native country or area. The clothing of the avatars and setting will also reflect the style of dance.

How will your design take advantage of agents in the environment (e.g., teachers, peers, technology)?

Details about your technology design

DancePro provides three different modes. Practice mode for those who are interested in taking virtual lessons with a virtual avatar instructor. Quick Play mode will be for those already familiar with dancing ready to try out their moves in an interactive club "cup" competition. In the competition, a couple or individual selects a style of dance as well. The users then compete against either computer opponents or human components online. There are three winners to the cup and users can gain points by winning the competition. These points can be used to purchase bonus lessons, songs, and authentic dance clothing for their avatar.

The last mode is career mode where beginners can start from scratch. Users travel the world to become a "world renowned dancer", learning different styles of dance and competing in competitions (against computer opponents).

An additional online mode will be a subset of the career mode. Users/couples will be able to travel around the world to become world renowned dancers by competing against human components via the Internet. The game play will be identical to the traditional non online version with the exception that users will compete against human components from around the world that are ranked in their "DancePro Dance Level." A dance level is the level of skill a dancer is at; consequently, experienced DancePro players will compete against other experienced DancePro players. In order to advance to the next class, learners must earn experience points by competing around the world.

- *the kinds of software-realized scaffolding you will provide, and examples of each*

DancePro's dance teacher avatars will provide specific criticism to the learner's moves and performances. The virtual environment will give the users feedback that they could never receive in real life. Time can be slowed and the in-game camera can zoom and center toward the specific part of the user that made a mistake.

- *How are the technological pieces integrated with each other?*

The software accepts motion capture information from the special hardware devices worn by the learners.

Use of the technology (scenarios)

Scenario 1
Learner: Bob
Objective: Learn a hip hop move

Bob turns on the game. On the television screen, a menu appears with "Career", "Quick Play", and "Practice." Bob chooses Practice where a sub menu with “Single” or “Couple” as two selections to choose from. Seeing that Bob wants to learn the Hip Hop Footwork, a single person dance class, he selects “Single”. Bob is then prompted to select or create a new avatar to represent him in the DancePro tutorial; Bob selects an avatar he has already created. The screen then shows the virtual dance floor, with Bob’s avatar along with hip hop music in the background. Along Bob's avatar are other computer avatars.

The screen shows the virtual avatar instructor on the screen. She introduces herself as Anna and also explains to the avatars what the class will teach. The first footwork move she will teach is the moonwalk. This stage of the game is the tutorial phase, where Bob will learn the dance before being performing it at Quick Play or Career Mode (in one of the dance competitions).

First, Anna demonstrates/models the move graphically while orally explaining. She says (while modeling the move), "The moonwalk is a very famous move seen by Michael Jackson. It is also known as the back slide. The moonwalk is easy to learn but hard to master as it requires a great deal of muscle memory and ankle strength..." The camera zooms toward her feet where one

foot's heel is up while another is flat. She explains that first you slide the flat foot backwards and then lift it on its heal and flatten the other foot and repeat the process. During the tutorial, color-coded footstep indicators appear on the floor, each color representing a corresponding foot. The left footstep pattern (in green) slides back, away from the current position of the avatar's left foot and stops. An arrow of the same color connects the position of the avatar's current left foot to the position of the footstep indicator. During this entire time, the DancePro virtual tutor is instructing Bob in an auditory and visually demonstrative fashion. Bob follows the visual instructions by positioning his feet in the real world as done by Anna. On screen, the avatar does the same thing, due to the motion detectors Bob has been wearing on his feet. Once Bob successfully moves his foot to the right position, both in reality and in the DancePro avatar, the tutorial will deem the dance step was performed correctly, and instruct him on the next step (switching the heel up foot to flat and the flat to heel up). Bob makes a mistake however and slides the wrong foot. A help icon appears on the screen as DancePro detected a mistake. Bob decides to click the help icon. Immediately, the camera replays back what Bob just performed (via Bob's avatar) and zooms into his wrong foot sliding back. While this replay occurs Anna explains, "You made a mistake. You slid the wrong foot backwards. Often, people watch the Moonwalk and think that the foot that is heel up should be slid backwards when really you should slide the flat foot. Watch me and try it again." The camera then turns back to Anna and she performs the move but slows down at the point where Bob made a mistake. Bob performs it again and Anna exclaims, "Great! You got it! Keep practicing and let me know when you're ready." Bob continues to practice for a few minutes before clicking on the screen to continue to the next dance move.

Scenario 2
Learners: Bob and Monica
Objective for Monica: Learn how to follow and perform a right-hand turn in salsa dance.
Objective for Bob: Learn how to lead and perform a right-hand turn salsa dance.

Bob now wants to learn how to dance salsa with his friend Monica. After selecting all the settings and avatars per learner, the tutorial phase begins similar to that of above.

The salsa instructor, named Carlos, introduces himself to Bob and Monica in a Spanish accent; "Hola. My name is Carlos and I'm from Spain. I'm a second level salsa instructor. To start, I will teach how to both lead and follow a right-hand turn…" Bob's avatar is indicated as the leader, while Monica's is the follower. Carlos explains the dance steps required for this specific technique, using color-coded footsteps to indicate each of the learners' avatars' feet. The mechanics of their body movements are animated on screen, indicating where each learner must move his or her body parts, similar to how Anna instructed Bob during the Moonwalk tutorial.

So at the beginning of the lesson, Carlos introduces his partner teacher Isabelle. Isabelle introduces herself and explains that she will be teaching the female part of the move and Carlos will teach the male part. Isabelle "asks" the females of the class to join her as she shows them the basic steps of the move. In the real world, Bob steps aside and watches Monica practice. Isabelle explains the steps and the camera shows her perform the forward step then spin. Isabelle explains that the man will lead this move by raising his hand up. Isabelle says while teaching the move, "The reason he will put the hand up is because you will be using his hand to help you turn." She teaches it count by count and waits for Monica to perform the step correctly. Monica seems to

have no trouble and Isabelle says they are done practicing. Carlos then brings the men over and has the men of the class perform the steps. Carlos explains, "The men's part of this move is very easy. On the 3rd count simply raise the girl's right hand up above your head and perform the basic steps you learned in Level 1 lesson." Since the steps are very similar to the basic steps that Bob already knew, Bob has no trouble. Carlos then asks the woman to come over and join the men to practice this move. Carlos first demonstrates the move with Isabelle and points out the mechanics as he performs them. The camera also zooms in to show when he raises his hand as well as when the lady steps forward to turn. Then Carlos asks the class to perform the move. Bob and Monica join together and practice the move. As soon as she makes a mistake, a "help" icon appears on the screen. Monica decides not to press it yet and wants to try the move out a few more times. She sees her avatar on the screen replay her last move and she notices that her moves don't look quite right. Ordinarily, if Monica makes a mistake she likes to practice it until the help icon goes away. But since it hasn't, she finally decides to press it. Isabelle pops on the screen. Isabelle explains that Monica is apparently spinning too early. Isabelle talks as a recent playback of the mistake is shown in 3D (when the mistake occurs time slows down), "The follower turned too quickly. Keep in mind that in Salsa, there is a hesitation between the 3 and 5 counts. Try and turn on the 5th count. Watch me." A split screen is shown of Carlos and Isabelle performing on one side and Monica and Bob performing on the other side. It's clear to Monica now based on the split screen that she needs to wait to turn. They perform it again and succeed.

Further testing needed

In order to determine the effectiveness of DancePro, users would need to be able to interact with our software. Observing the users and then discussing the software would be the best way of gathering data. Many of the issues would be usability related (if the users could understand the footsteps); however, these usability-related issues would affect the learning experience of the users.