

Stanford University / CS 247 - Winter 2012 / Project 2

A Gesture-Based Learning System for Dance Groups

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1. Choosing an Application Area

We brainstormed potential application areas for this project during our first meeting on Friday, January 13, 2012. We eventually narrowed our interests to retirement communities, dance groups, and food preparation; and we each took on the task of contacting representatives from relevant organizations on or near the Stanford campus. Ultimately, our only lead was with Stanford Dil Se, a dance group specializing in the Hindi film genre. The notes from our project group's early exchanges are enumerated below.

1.1 Brainstorming Application Areas

NOTE: **Bold** denotes items of particular interest after this phase.

1. cooking
2. pottery
3. shopping
- 4. old age homes**
5. gym - check form, correct, less injuries
6. mechanical work
7. teaching
8. dance
9. karate
10. gardening
11. quarterback training, how good they are getting, progress measuring
12. medical
- 13. emergency training**
- 14. kids - puppet, teaching basic**
- 15. sports**
16. musicians
17. mobs
18. cops
19. physical therapy
20. schedule zooming
21. drive thru
- 22. dance groups**

1.2 Narrowing Down Our Top Choices

1. **Old Age Homes**
 - Long administrative procedures
 - Might be under quarantine due to illness outbreak
2. **Campus Dance Groups**
 - Dil Se and Urban Styles (on campus)

- Could interview Vibha Laljani (former dancer; works at Oracle)
3. **Food Preparation**
 - Could observe cooking at Synergy
 - Could observe drive-thrus, etc.

1.3 Assigning Action Items

Here are some responses we received after contacting organizations nearby:

1. **Palo Alto Commons (Senior Assisted Living)**
 - Can't accommodate this weekend
2. **Lytton Garden (Senior Assisted Living)**
 - Need permission through administrator, right now on quarantine
3. **Dil Se (Stanford Dance Group)**
 - Rehearsing Saturday, January 14, 2012 from 5 - 6 pm in Roble 38
 - Can accommodate!
4. **Off-Campus Dance Group**
 - No practice this weekend (only meets on on Wednesdays)
5. **Salseros (Stanford Dance Group)**
 - Optional rehearsal on Sunday (likely that no dancers will end up going)
6. **Belmont Village (Senior Assisted Living)**
 - Never got a response
7. **Contacted Kunal (Member of a Stanford Dance Group)**
 - No practice this weekend

2. Observation and Interviews

After deciding to pursue dance as an application area, we dispatched our group members to observe the dance rehearsals for Dil Se (a Hindi Film group) and Urban Styles (an LA-style jazz group) over the weekend of January 14-15. We compiled all of our observations—the lists of which are shown below—and then agreed on a subsequent meeting time to discuss further ideation based on our findings.

2.1 Observations from a Dil Se Rehearsal

2.1.1 Arti's Observations from a Dil Se rehearsal

- During the practice of dance steps involving a lot of repositioning of the dancers, many a time the dancers crashed into each other
- Refining steps, adding steps on the fly
- Testing flexibility of each member for steps involving lot of bending/stretching
- Everyone was not clearly visible in the mirror - a tall guy would end up dancing right in front of a shorter girl
- Used normal speakers meant for a PC and a laptop
- All huddled together to watch a reference video on the laptop. Position: laptop on the floor, 10 dancers standing and looking down at it
- Split the group into two to try two different formations/steps for comparison

2.1.2 Wendy's Observations from a Dil Se Rehearsal

- Hard to give feedback to every dancer when trying new move
- Leader stands in front-does everyone have a clear view of her AND the mirror?
- Hands-were they mimicking some sort of prop?
- Barefoot casual workout attire
- Bringing in chairs/equipment from far
- Usually rehearse 1 8-count or sequence, stop, people offer suggestions or questions, do it again
- How to make answering individual questions easier without stopping the whole group?
- 4 to 5 people seem to lead, others are pretty quiet
- Use mirror to see which versions of a move look better

2.1.3 Gary's Observations from a Dil Se Rehearsal

- Scott has been abroad, he learns by observing the group from the sidelines
- Divide between observation and imitation: it is difficult to do these simultaneously wh

- Mirrors used to match gestures, synchronization of dance steps—how helpful?
- Running back and forth between stereo
- Typing new urls, youtube queries, itunes searches, when playing songs
- Leader must count in time with dance, everyone watches one person for cues
- Leader miscounts, entire group starts over
- When coming up with gestures, team would like to see a move from all angles
- Come up with gestures based on how they look in the context of an entire group
- Group tries to visualize gestures in different ways
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2.1.4 Chris's Observations from a Dil Se Rehearsal

- 10 Dancers at rehearsal (5 females, 5 males), director said this was half of the actual group
- Dancers face the floor-length mirror for the entire rehearsal
- One primary leader/director counting and leading rehearsals
- One or two others standing by to help point out errors in dancers' execution of various moves in the routine
- Repetition seems to be the most-leveraged tactic for getting perfect synchrony
- Lots of chit-chat, exchange of new dance ideas between members
- Choreo seems to be pre-determined, though some harder moves might change as per members' weaknesses or requests
- Leader works as few as one count at a time, repeating it until dancers are all doing the associated move correctly
- Precision seems to be very important—members are very attentive to the tiniest inconsistencies in form across all dancers

- Dancers rehearse with music (lots of starting, stopping, rewinding, etc.)
- Extended discussion about dancers they've seen from other schools on YouTube, mention of things they liked and didn't like about those other performances
- Lots of downtime for regular members when leaders are tossing ideas around
- Dancers seem excited when they see a new move executed well by everyone at once
- Several instances of improvisation that led to new choreo during the rehearsal
- Takes a long time for the group to get through even a few seconds of the final dance routine

2.2 Observations from an Urban Styles Rehearsal

2.2.1 Clare's Observations from an Urban Styles Rehearsal

- Use of mirrors to watch themselves and instructor
- Technology:
 - iPod, someone sitting there to control it, having to navigate back and forth in song imprecise and takes time
 - Computer to watch videos of other performances
- If leader unsure of choreography, no convenient way to double check during rehearsal
- Dancers break songs up into chunks of 8 beats, no convenient way to navigate like that or replay the same exact chunk over and over to practice
- Someone either had to sit by ipod instead of dancing or run over every time to stop/start
- Leader counted out sets of 8 as they danced
- Not everyone would do all the moves every time through
- If the leader wasn't dancing (to watch the group), there was no reference of what to be doing
- Had to bring their own speakers

2.3 Interview with Vibha Laljani

NOTE: Vibha Laljani is a passionate dancer who has choreographed dance shows for many India events at the high school/college level as well as at Oracle. We have paraphrased her replies from an audio recording of an interview we conducted with her.

Me: Can you talk a little about your dance shows in general?

Vibha: It's always interesting. You get to create new steps, adapt some. Get to meet different people. "There is a bit of drama which can be nerve wrecking." But this way you learn about yourself and human psychology.

Me: Okay so this is an open ended question. What fascinates you about dance?

Vibha: It's a good exercise, very therapeutic and you can express yourself through dance. Dances with different themes can be used to communicate a lot of ideas.

Me: Walk me through the entire process of coming up with a show from day 1 when you go like "Let's aim for XYZ function/competition" to the final day when you execute the performance.

Vibha: I have been on the show committee quite a few times. We get together and first decide a theme based on the program in mind.

Me: How does that work?

Vibha: Normal brainstorming. Watch videos. Decide themes suitable for the audience. Take a few days to discuss these aspects and then meet all the members who will be helping with the show. After basic details chalked out, we go to the choreography part. Select songs based on the theme. Select some songs which have good choreography already in place and some songs we choreograph from scratch. Audition the dancers for the group based on their style as well as skill. We designate songs as easy, medium and hard level. Some members who are in the show for fun and are not great dancers maybe get selected for the easier dance numbers.

Now either the choreographers (who also are members of the group) get together and plan all the steps in advance or do it on the fly during the practice session.

Me: Are there specific people to plan out the choreography or all the members of the dance troupe can chip in?

Vibha: To keep things less complicated, only the selected few choreographers plan the steps. If the step is too hard then rest of the members can suggest alternatives.

Me: How many members do you normally have in a group?

Vibha: 6 is a nice number. Enough people to fill the stage. Not too many interruptions or questioning of authority.

Me: Run me through a day when you have your practice.

Vibha: All don't come on time, so lose time there. Once people come, they all want to hear the song. Hear the part that we are learning. Then you start teaching them. Show them the entire choreography with music. Then I break it down and teach with counts. Then sing verbally, so that you can go at a slow pace. Play music and see if the timing is right. Once the group has picked up the step, move to the next step. We rehearse a part multiple times and then rehearse all the parts in a sequence.

Me: How do you chunk a song into different parts?

Vibha: In Hindi songs, every step for a sentence. Else, normally 8 counts makes a good chunk.

Me: What about people in your dance group dancing to Hindi song but don't know the language well?

Vibha: Music and beats do help them in getting the steps right, but we all explain to them the lyrics to get a better sense of what kind of facial expressions they need to practice.

Me: How do you check if everyone is doing well or is on track?

Vibha: I keep checking up on them in between. No one person is specially assigned to supervise. So initially I dance with the group so that they can watch me and learn, later I just walk around and see if they have picked it up well. This helps me test if they remember the steps as well as do them with precision. CPoint out details - jazz hands vs closed hands, pointed toes.

Me: How do you foresee the final look of your performance? Stage, clothes, props?

Vibha: We have some idea of the entry/exit points of the actual stage. I have not had a big group, so don't really worry about running out of space. Dress rehearsal before the show helps!

Me: Infrastructure wise, what do you have to manage?

Vibha: Make sure room has speakers. Else we carry them as well as wires to connect. Need to have the right version of the song as people get attuned little hints in the music. Make sure people are wearing the right attire. Not super tight clothes. Look out for mirrors.

Me: What other ways do you adopt for practice?

Vibha: We record the practice session and upload on youtube. Not sure if people look at it and practice. So normally end up practicing a lot more when we all meet up.

Me: Normally how long are your performances as well as the practice duration?

Vibha: Normally we prepare a 4-5 minutes show. Practice 2-3 times a week, for a couple of months.

Me: Anything else you want to add about making the practice experience better?

Vibha: Choreography is hard as we are not professional dancers. In addition to my own dance step ideas, I go through videos of other choreographies of the same song/similar theme. Would be great to get step suggestions based on music. Also would help if the floor was marked. Oh and yes if the dancers became punctual and well prepared!!

Me: Thanks Vibha!

3. Ideation

Our observations illuminated many design opportunities to help improve various aspects of a dance group’s rehearsal time. We first clustered our notes into more general need “buckets” and subsequently deduced a set of themes for our design ideas. After a three-hour meeting on Monday, January 16, we came up with a number of interesting ways in which gesture in particular could be leveraged to improve the rehearsal experience for dance groups.

3.1 Synthesizing Needs

Needs were clustered around the following themes:

- Visualizing how it will look in performance space
- Instant feedback during individual practicing (or as a group if possible)
- Comparing videos/visuals with the same audio (auditions, different move sequence options)
- Having visual cues in case someone gets lost so the whole group doesn’t have to stop (e.g. visual metronome)
- Navigating through songs and videos (gestural/audio interface)



3.2 Synthesizing Design Ideas

Design ideas were clustered around the following themes, in response to the needs above:

- Simulating the performance environment
- Individual practice and progress tracking
- Group planning and practice
- Choreography: the process, creating ideal reference versions of piece
- Continuous references and feedback to avoid interruption of the group rehearsal flow
- Gesture/audio-based commands for audio and video navigation



3.3 Shortlisted Design Ideas

The following were among our favorite ideas for improvement to the design of dance rehearsals:

- Record ones moves/choreography and project it on an avatar.
- Project moves from other videos onto the avatar.
- Auto-suggestion for steps.
- Gestural/voice control to play audio, video or navigate through it. (Swipe gesture for start/stop)
- Easy sharing of choreography.
- Performance progress of an individual member.
- Audio cheering, encouragement as well as progress. (John, great job...you are 80% done!)
- Precision feedback on certain physical actions.
- Virtual instructor
- Virtual mirror
- Annotate section where a member screws up
- Project on the floor



3.4 Assigning Action Items

After this ideation meeting, we assigned the following action items to help us prepare for our final meeting on Tuesday, January 17.

1. Script - Chris
2. Compiling submission document - Chris, Arti
2. Props - Gary (Wendy?, if we do need more hands)
3. Storyboard - Clare

4. Bodystorming

After the ideation phase, we wrote a skit to visually and actively explore the feasibility of our hypothetical design opportunities.

4.1 Skit Outline

We wanted 3 scenes showing various stages of a dance group's learning process:

1. **Scene 1 - Director's Dorm Room**

Director introduces him/herself ("another day in the life of Lee Dancer, Dance Group Director)

Dancer mentions s/he needs to come up with a new routine ("let me step in front of my gestural interface that's designed to help me do that!")

Dancer says she'll give a sample of a move she saw before (throws arms in the air + stands in X shape, makes an O and rolls it down and around her head)

System analyzes motions and suggests videos of similar moves done by dance groups on YouTube

Director browses videos and selects YMCA one w/ gestures, draws a play button to play it (after she watches it)

Okay, let me record one perfect take for my dancers to learn from! I'll also have the system multiply me and show an entire troupe doing the same moves behind me on the screen, just to make sure it looks right (does YMCA)

Sends to dance group using "shoo" motion

2. **Scene 2 - 3 Member's Dorm Rooms (Parallel/Concurrent Scenes)**

3 people standing in horizontal line, learning concurrently in their respective rooms

"when the dancers received the director's video, they each practiced the routine until they got it just right"

one after the other, they each attempt it (first one is perfect, second one is okay, third one is awful)

1 - System yells "Perfect execution, Person 1! I'll send a video of this last run-through to your director for her to review."

2 - System yells "Decent execution, Person 2. I detected your arms were a few degrees off on Beat 1. Keep rehearsing as your director's video plays in front of you, and you'll get it!"

3 - System yells "Needs more work, Person 3. I can try slowing down the video or looping each beat until you learn each of the moves, if you want?"

"Sounds good"

(after more practice)

Perfect Person 3! Here is a plot of your overall execution accuracy for each take. I'll send a video of this last run-through to your director for her to review."

3. **Scene 3 - Group Rehearsal**

Director calls for a run-through (the system will monitor our dancing in real time.

during run-through, one dancer messes up and a red dot appears over their head.

after the run-through, the director mentions that the system annotated where there was a mistake in the song

director uses gesture to skip back to spot and watch

tells dancer: should have been a C not an O!

next run-through = perfect!

group yells something excitedly

Possible Props for Skit

- Role stickers for dancers, virtual instructor, instructor, "features"
- Music player
- Large frame
- Flash lights/bike lights

4.2 Skit Script

From the outline above, we proceeded to write the following skit to communicate our ideas for ways in which a gestural interface might improve the experience of a dance group's rehearsals.

Scene 1: Director's Dorm Room

DIRECTOR. Another day in the life of Lee Dancer, Dance Group Director. Looks like it's time for me to come up with a new routine for my group. Let me step in front of this gestural interface that's designed to help me do exactly that!

Steps squarely in front of an imaginary screen, striking a superman pose.

DIRECTOR. I saw an interesting move recently. I'll have the system analyze my motion and suggest YouTube videos of other dance groups doing visually similar moves.

Director mimes some swiping interactions as if navigating to the suggestion feature in the system.

DIRECTOR. (To system) Start Dance!

Director strikes a full-body X pose, then makes an O-shape with her arms that she swings down and back up around her head.

DIRECTOR. (To system) End Dance! (System returns results.) 10 results! Let's try this one.

Director gestures to select a video, then taps on it to play.

RANDOM VOICE. (Facetiously in an obvious, time-saving way) AFTER SHE WATCHES IT...

DIRECTOR. Okay, let me record one perfect take for my dancers to learn from! I'll also have the system multiply my figure and show an entire troupe doing the same moves behind me on the screen, just to make sure it looks right. Start Dance!

Director does YMCA dance.

DIRECTOR. End Dance! Now I'll send it to the rest of my group, so they can learn from it!

Mimes a comical "shoo" motion with both hands to send the video to Dancer 1, Dancer 2, and Dancer 3.

Scene 2: Three Member's Dorm Rooms

Three dancers stand squarely in a horizontal line on stage, each clearly in their own world.

DANCER 1. What's this—a video of a new dance routine, from the director!

DANCER 2. We will practice this on our own...

DANCER 3. ...until we get it just right!

RANDOM VOICE. (Again, facetiously) THEY EACH WATCH THE VIDEO.

DANCER 1. Okay, I'm ready to try it myself while the gestural...

DANCER 2. ...system analyzes the accuracy of my dancing. Here goes...

DANCER 3. ...nothing!

ALL DANCERS. Start Dance!

The dancers simultaneously do the YMCA dance. Dancer 1 does it perfectly, Dancer 2 does it somewhat well, and Dancer 3 does it poorly.

ALL DANCERS. End Dance!

SYSTEM. (To Dancer 1). Perfect execution, Dancer 1! I'll update your progress and send a video of this last run-through to your director for him/her to review. (Dancer 1 mimes excitedly.)

SYSTEM. (To Dancer 2). Decent execution, Dancer 2! I detected your arms were a few degrees off on Beat 1. Keep rehearsing as your director's video plays in front of you, and you'll get it. (Dancer 2 nods in slight satisfaction and gestures to play the video again)

SYSTEM. (To Dancer 3). Needs more work, Dancer 3! I can try slowing down the video or looping each beat until you learn each of the moves, if you want?

DANCER 3. Sounds good. (Comically gestures to slow down the video, drag out a time duration, loop a beat, and play the video again.)

RANDOM VOICE. (Again, facetiously) AFTER MORE PRACTICE...

SYSTEM. (To Dancer 3). Perfect execution, Dancer 3! I'll update your progress and send a video of this last run-through to your director for him/her to review. Here is a plot of your overall execution accuracy for each take, if you're interested.

Scene 3: Group Rehearsal in the Gym

DIRECTOR. (To dancers) Alright guys, let's see what we've got! (To system) Start Dance!

The Dancers do the YMCA in slow motion. During the run-through, Dancer 2 messes up. As s/he does so, the person playing the system lifts a red dot over Dancer 2's head.

DIRECTOR. (To system) End Dance!

SYSTEM. Decent Execution, Dancers! There was one mistake on Beat 3, which I've annotated on the playback timeline.

DIRECTOR. Hmm, let me skip to that beat and watch it. (Mimes as if to taps the annotation and scrutinize the playback). Dancer 2, it's not the Y.M.D.A.! We need a C on the third beat!

DANCER 2. Okay, I'll fix it this next time.

DIRECTOR. Okay, here we go. Start Dance!

The Dancers do the YMCA perfectly.

DIRECTOR. End Dance!

SYSTEM. Perfect execution, Dancers! I'll update your progress and save this video for the director to review.

DIRECTOR. Now that's how you learn a dance routine efficiently!

Dancers huddle into a final pose and smile while striking a thumbs-up.