

Designing and Evaluating an **Advanced Dance Video Comprehension Tool** with In-situ Move Identification Capabilities

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Photo Credits: Washburn et al., 2014

An important first step in dance learning is often the **analysis of movements**, which can be achieved through **videos**.





Photo Credit: New York Times



Photo Credit: schoolintokyo.com

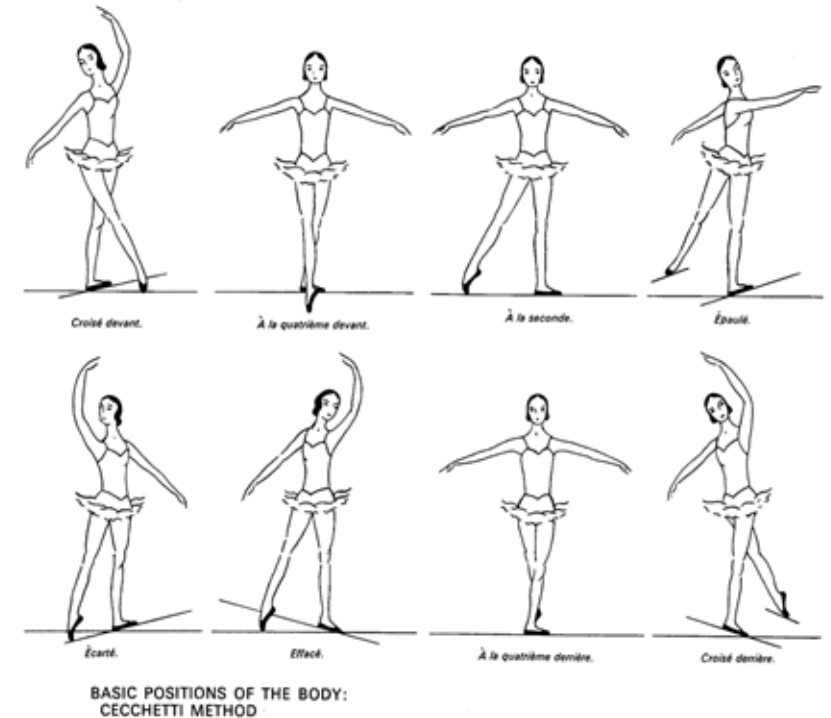


Photo Credit: Live to Dance

Dance forms, such as Ballet, Bharatanatyam, and Hula, sometimes adhere to a pre established glossary of moves, prompting learners to **focus on identifying sequences of named dance moves.**





Photo Credit: Freepik

Video Catalogs require specifying various properties of dance moves

Ballet Dictionary

A B C D E F G H I J K L M N O P Q R S T U V W X Y Z

A

air, en l'
[ahn lehr]



In the air. Indicates: (1) that a movement is to be made in the air; for example, rond de jambe en l'air; (2) that the working leg, after being opened to the second or fourth position à terre, is to be raised to a horizontal position with the toe on the level of the hip.

Photo Credit: Ballet Dictionary



Photo Credit: Salsayo



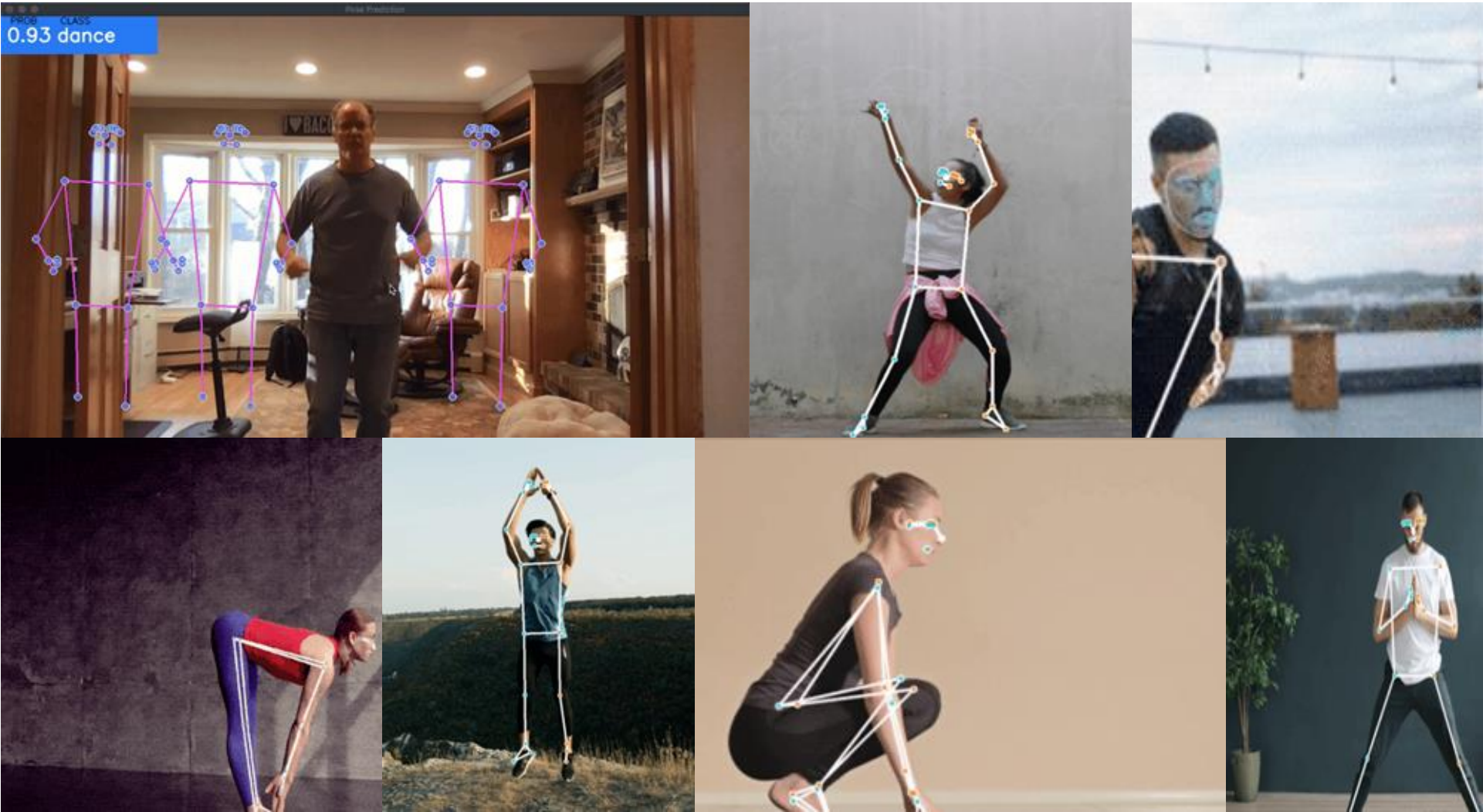
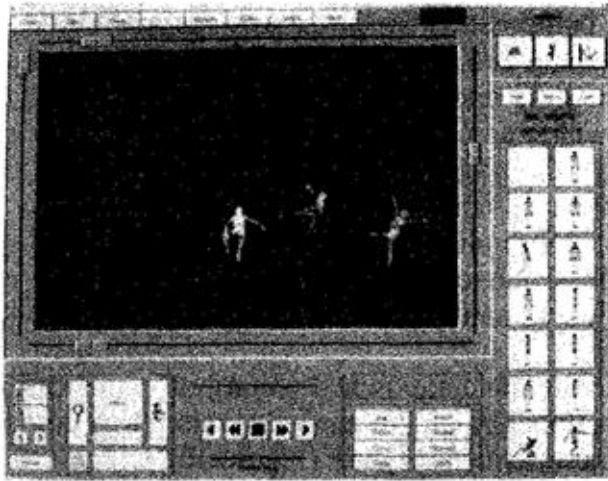


Photo Credits: Google MediaPipe

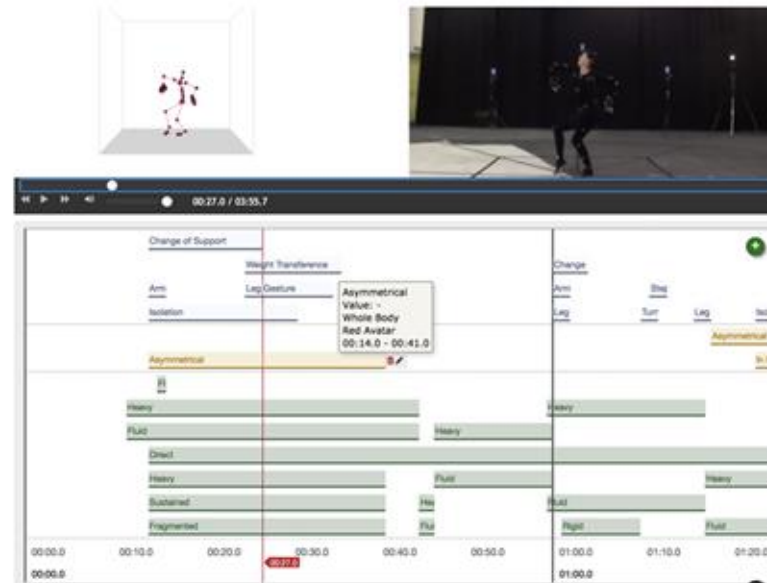
Advancements in machine learning (segmentation + recognition) will soon enable **auto-identification of dance moves using video input** [Yan and He, 2022].



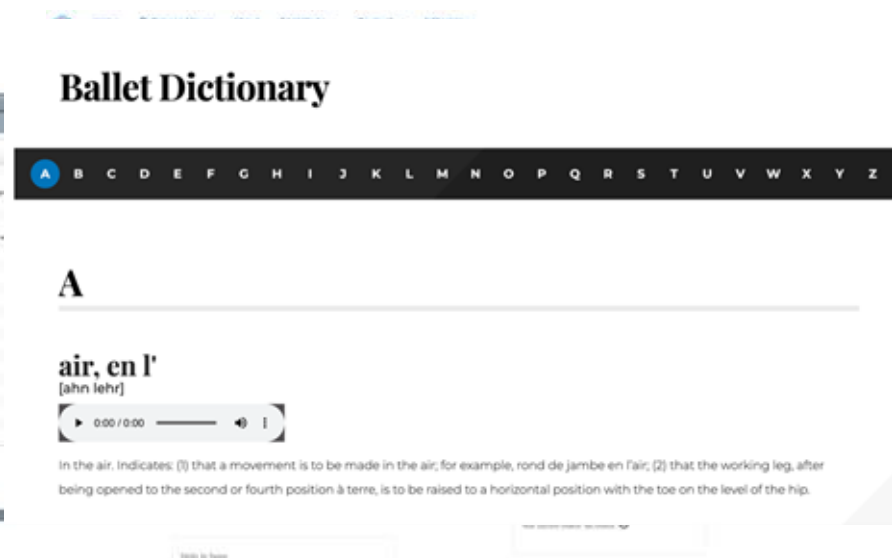
Related Work



Computational
Choreography Tools,
e.g., Calvert et al., 1993;
Soga et al., 2007

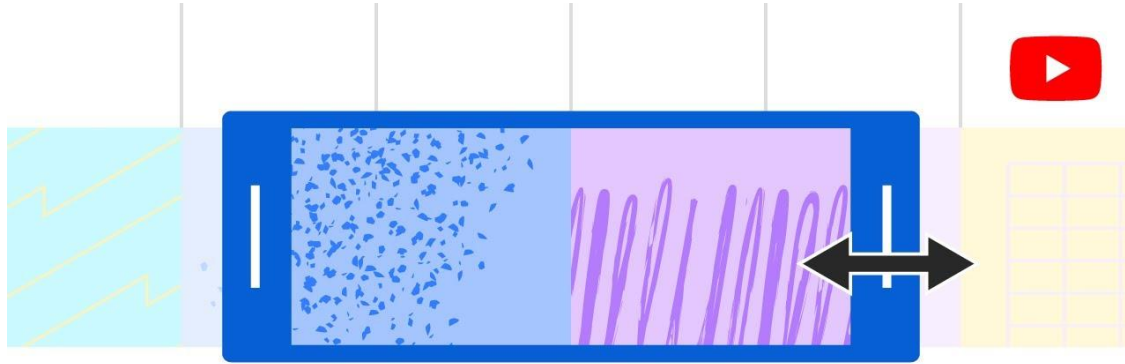


Annotation Tools or
Choreographers' Notebooks, e.g.,
El Raheb et al., 2018



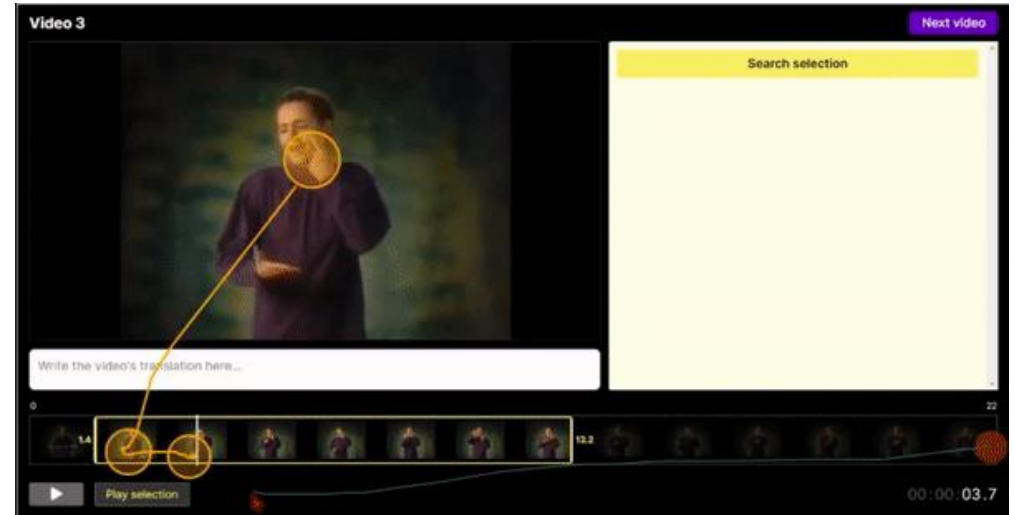
Archival Systems, e.g., Kannan et
al., 2011; Salsayo; BalOnSe





CLIPS

[YouTube Clip Feature]
Google Research, 2021



Hassan et al., CHI '22, Hassan et al., ASSETS '22
Dissertation: *Exploring Search-by-Video Technology
for Searching Structured Human Movements:
Insights from Sign Language Look-up Systems*



Overview



Interview Study with
12 Dance Learners



Dance Video
Comprehension Tool
Design



Experimental Study with
8 Cuban Salsa Learners



Interview Study

- 12 Semi-structured Interviews

Part 1: Dancing experiences using the story interview technique used in prior HCI literature on dance [Walton and MacKay, 2022]

Part 2: Approach to video-based dance learning; Memorizing and recalling dance sequences; Note-taking practices



Experiences of Video-based Dance Learning

“Instead of teaching the whole thing in one go, they'll teach you little segments so that it's easier to remember and you kind of just keep building on top of it.” - D1



Note-taking and Identifying Dance Moves

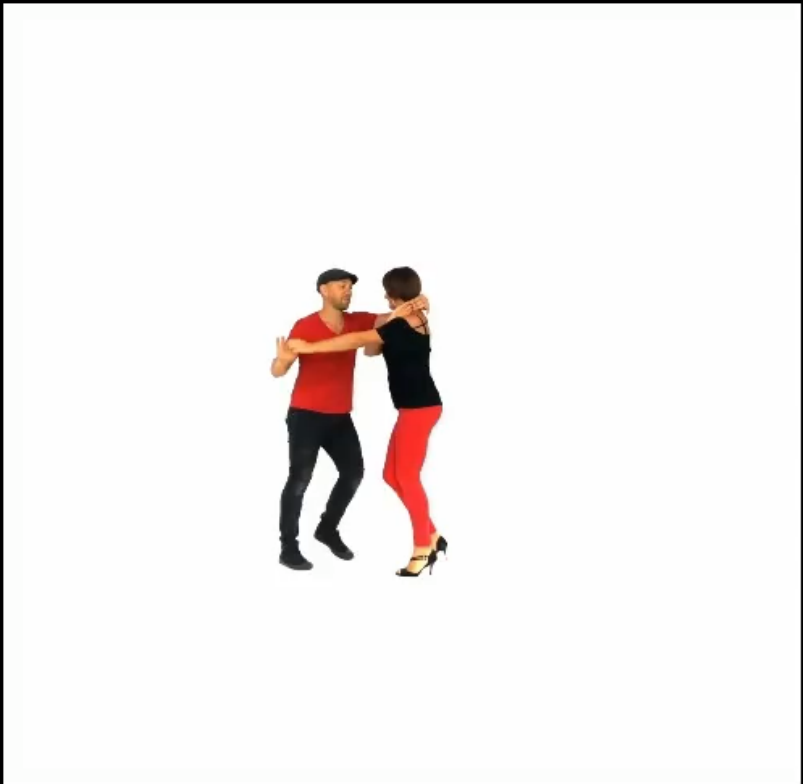
*“There have been countless times I've taken written notes. But in Ballet specifically, one of the most important parts is the names of the moves. One of the moves is called Pas de Chat... which means **step of the cat**... it makes more sense because the moves have a name for a reason. It correlates for me.” - D8*



YOUR DESCRIPTION OF VIDEO #3 Submit text

.....

SEARCH RESULTS



0 33

▶ Add annotation ▶ Play selection 🔍 Search in selection 00:00:21.2



Experimental Study

- 8 participants utilized our dance video comprehension tool and baseline (online dictionary + video player)
- Each participant wrote notes for 3 videos under both conditions

Notes quality

Workload

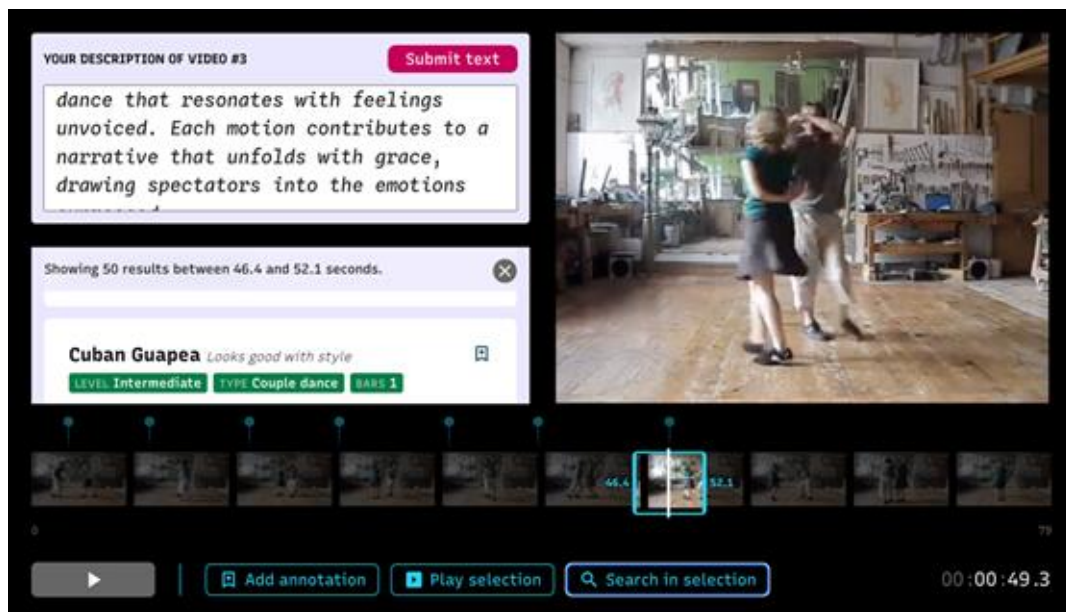
Interactions with the system

Observational Notes

Post Interview

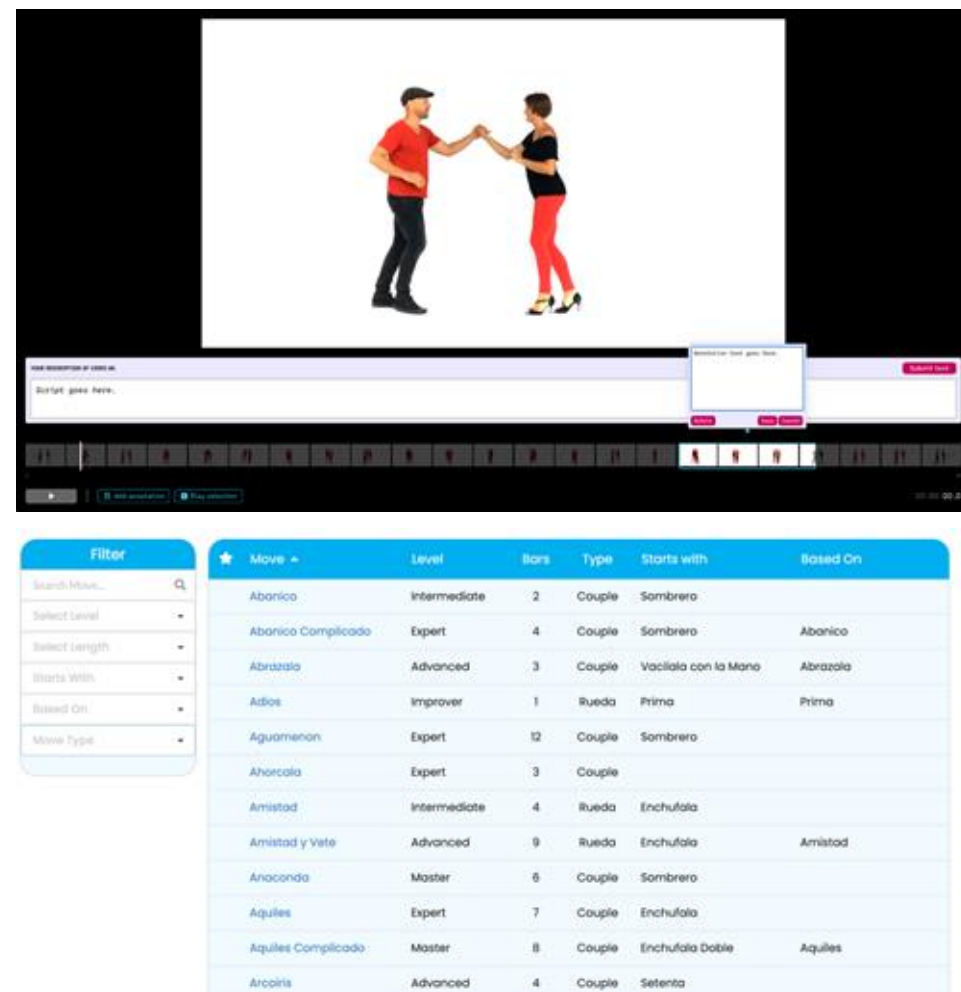
“Mix your methods and you will learn more about the same thing.”
- Wendy E. Mackay CHI '24





Dance Video Comprehension Tool

Vs.



Baseline



Notes Quality

Baseline: **5.65**

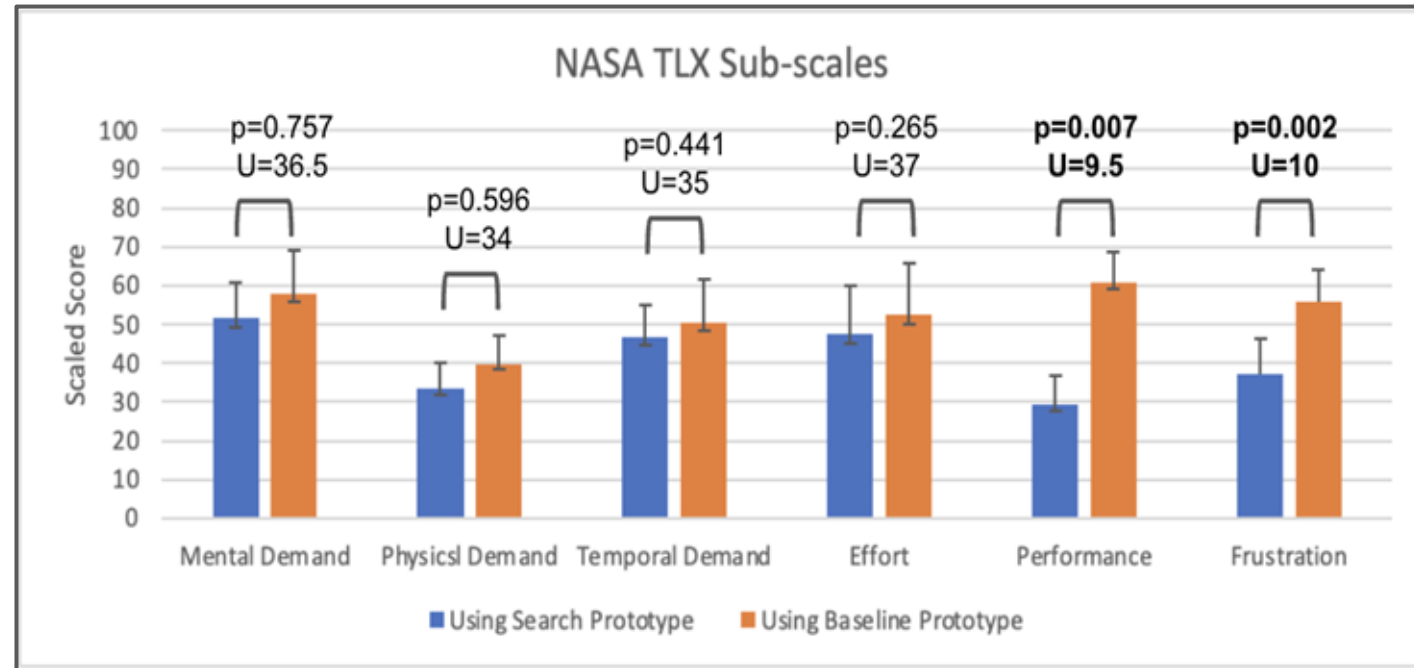
Video Comprehension Tool: **8.71**

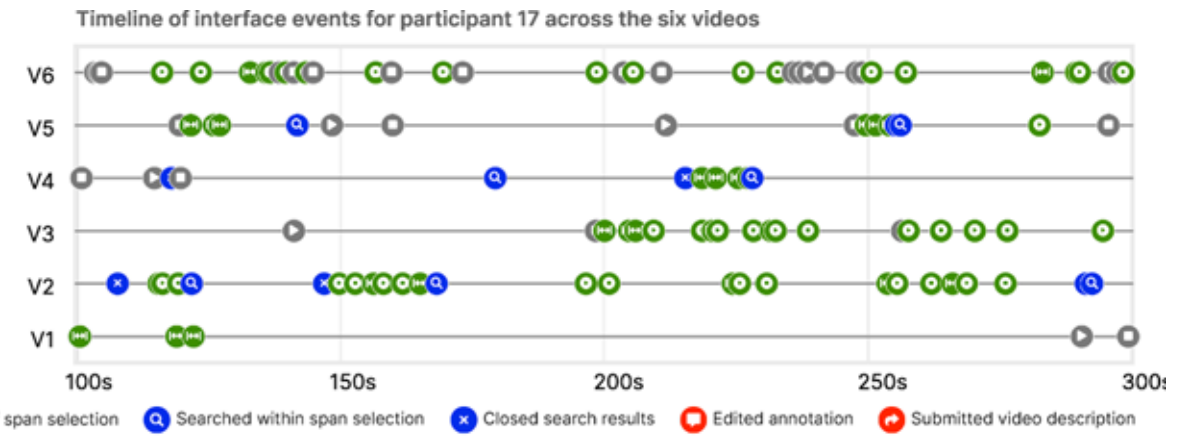
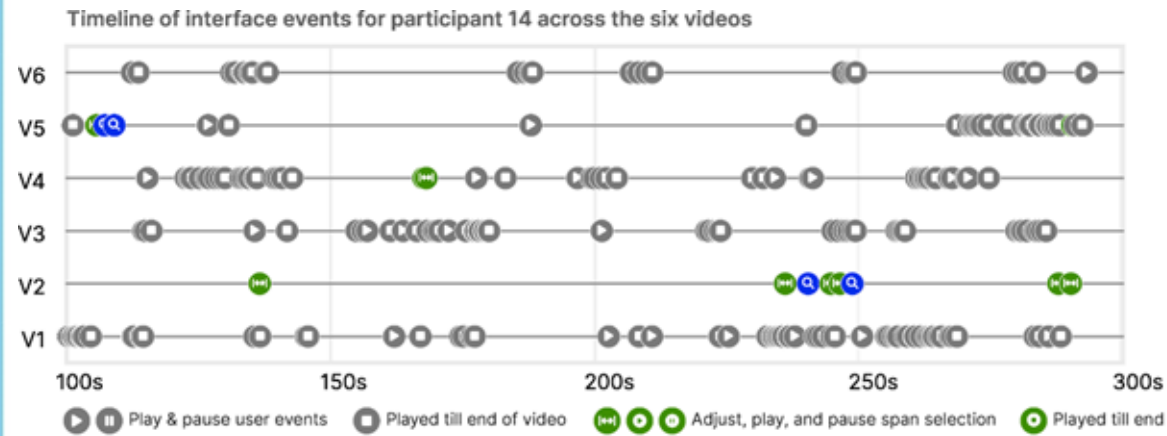
Mann–Whitney $U = 10$

$p = 0.032 < 0.05$

Two-tailed

Workload





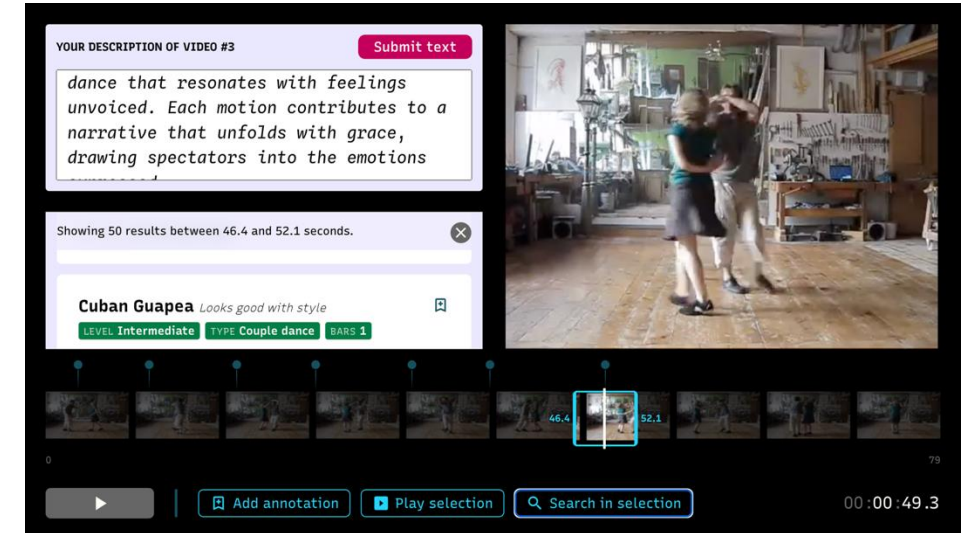
Chronological subset of the sequence of events undertaken by participants 14 and 17 while working on each video.

Auto-identification, constraining the playhead



Extending Design Guidelines

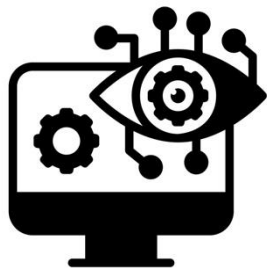
1. Timeline-based video playhead for sequential video navigation
2. Two note-taking features for timeline-specific notes and general notes; Auto-transfer of metadata to timeline annotations
3. Comprehensive metadata: body parts involved, difficulty level, similar moves, number of dancers
4. Textual descriptions with standardized numbering for each dance move
5. Videos displayed from various angles for comprehensive understanding



Whom do our findings inform?



For **developers**, our findings provide evidence supporting the integration of a span-selector to refine and analyze videos. We offer insights into potential usage patterns and suggesting design recommendations.



For **computer vision researchers**, we introduce a novel task involving user-selected segments as inputs for automatically identifying dance moves according to a predefined glossary.





Faith Avi DePano





Saad
Hassan



Will Silver
Wagman

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Caluã de Lacerda
Pataca



Laleh
Nourian



Garreth
Tigwell



Brianna
Davis



RQ2: In a comparison between the experience of users who performed a series of **dance video annotation tasks** using a video comprehension tool with dance move identification capabilities versus an online catalog of dance moves:

- A. Is there a difference between **task performance** and **workload**?
- B. How did they **make use of the systems' features**?
- C. What **challenges** did they still face?



RQ1: What are the **experiences** and **challenges** of dance learners who watch videos to write notes?



YOUR DESCRIPTION OF VIDEO #3

Submit text

dance that resonates with feelings unvoiced. Each motion contributes to a narrative that unfolds with grace, drawing spectators into the emotions

Showing 50 results between 46.4 and 52.1 seconds.

Cuban Guapea *Looks good with style*

LEVEL Intermediate TYPE Couple dance BARS 1

Timeline with a selection box from 46.4 to 52.1 seconds.

0 79

▶
Add annotation
▶ Play selection
🔍 Search in selection

00:00:49.3

YOUR DESCRIPTION OF VIDEO #6

They move in a counter-clockwise direction, taking three steps for every three beats of music, executing a box step pattern: forward step with the left foot, side step with the right foot, and then a closing step with the left foot.

CLICK ON PIN TO EDIT ANNOTATION

0 33

▶
Add annotation
▶ Play selection

00:00:26.6

Siete *Seven*

LEVEL Improver TYPE Couple dance BARS 1

DESCRIPTION: For this move, there must be Contra on 1, and this is achieved by giving the follower a slight pull inside on the 7th beat of the previous count.

On 1-2-3 follower walks like in a Vacilala, but leader does $\frac{1}{2}$ a left turn while walking to the center of the Rueda, thus blocking the followers way. The leader stops the follower with its right hand on 4.

On 5 the leader slightly pushes the follower back, and does a $\frac{1}{2}$ turn to the right while walking, thus getting back to the initial position.

Note: the lead in Siete is sharper than in Vacilala, and is more to the inside rather than to the side.

RUEDA SIGN: *Pointing downwards with the index finger and with the thumb in 90 degrees to form a seven symbol.*

STARTS WITH Tap
BASED ON Vacilala
SYNONYM Panque

