

Dance With Me, You Versus All: Exploring Time and Space History using Body Movement

Tiffany Quon

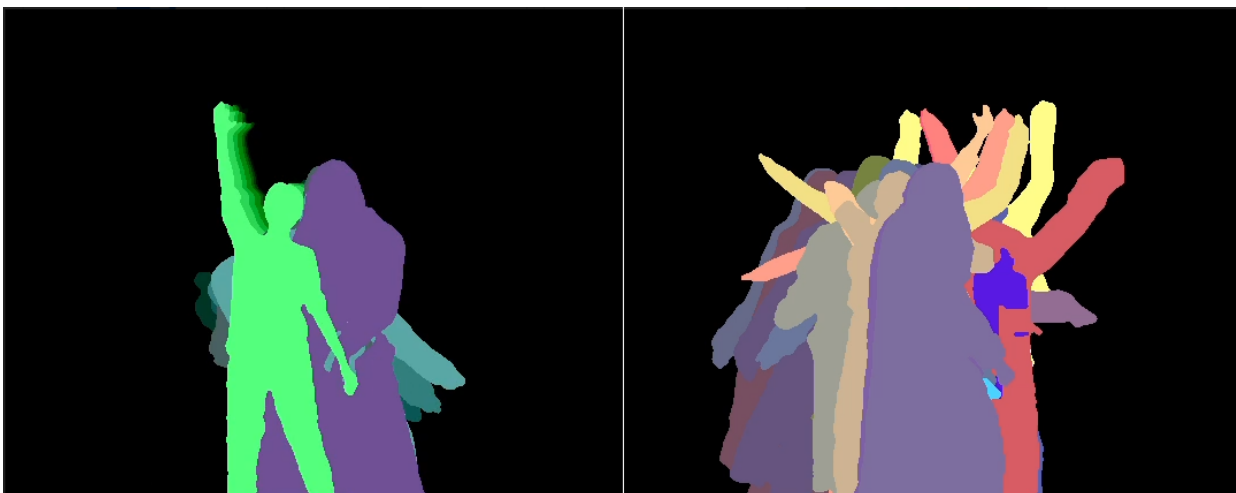


Fig. 1. The two main components of You Versus All: a live image view where the user can see their movement in real time (left), and a static output image view where the user can see an output piece of artwork being generated in real time (right). Both views are updated by the user's movement.

Abstract—Dance With Me is an interactive art installation that aims to explore people's relationships with the data they generate and how this data might be used to connect with other people. The installation allowed users to use their body movement to generate artwork using their own movement data and the movement data of the user who last used Dance With Me. You Versus All was added to Dance With Me to additionally allow users to generate artwork using the movement data of the last 25 Dance With Me users. This data set is a reduced representation of all past Dance with Me users. As the user moves around in a set duration of time, You Versus All displays the silhouettes of past users who were at the same location in space at the same relative time step. These silhouettes are stamped onto an output image as they are retrieved, thus allowing the user to generate artwork using past users' data. You Versus All was tested with six users to evaluate its overall user experience.

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1 INTRODUCTION

There are many ways that people can continually generate digital data. For example, web browsing history, taps and scrolls inside apps, and overall screen time can all be continually tracked for users. The creation and storage of this data is generally not the driving purpose of a user's actions: people often use technology for reasons beyond generating data about their behaviour.

Dance With Me is an art installation that aims to explore this relationship between people and the data they generate. A user can use their body movement to generate artwork with their own data and the data of the person who last used Dance With Me. The current user is thus reliant on the data generated by the user before them. Additionally, the current user must generate their movement data knowing that this data will directly affect the experience of Dance With Me's next user. By placing emphasis on the impacts of one's data, Dance With Me aims to encourage users to be aware of the data they generate and to question their comfort with sharing this data. This installation is actively being developed for my undergraduate capstone course.

To allow users to explore the data of all previous Dance With Me users, and to allow users to contribute their movement data to a persis-

tent pool of data, I created You Versus All, an additional visualization for Dance With Me. As a user moves around in a set duration of time, You Versus All retrieves and displays the silhouettes of past users who were at the same location in space at the same relative time step. These silhouettes are stamped onto an output image as they are retrieved (Fig. 2), thus allowing the user to generate artwork using past users' data. This user's movement data is then stored in You Versus All for future users to potentially generate artwork with.

You Versus All contributes to Dance With Me by further highlighting the user's dependence on past users' data and the user's obligation to share their data with future users. Additionally, with the creation of You Versus All, Dance With Me can take users through several stages: the user first generates artwork using only their data, then with their data and the last user's data, then finally, with their data and all past users' data. This encourages the user to compare and contrast their feelings about their data in multiple contexts.

2 DOMAIN, DATA, AND TASKS

Dance With Me is an art installation whose main purpose is to provide an engaging and enjoyable user experience. It consists of the following visualizations: You Versus You, and You Versus Previous.

You Versus You is a 20 second visualization of the current user's movement (Fig. 3). The output image generated is a heat map of the locations the user frequents the most in space. You Versus Previous is a 20 second visualization of similarities between the current user's

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Fig. 2. As the current user moves around, You Versus All will look for a past user whose right hand was at the same place at the same time as the current user. In this image, the pink user at the foreground of the left image is the current user. The bright yellow silhouette is retrieved, displayed on the live image behind the current user's silhouette (left), and is stamped onto the output image (right). The other silhouettes in the live image belong to the trails of previously retrieved user data.

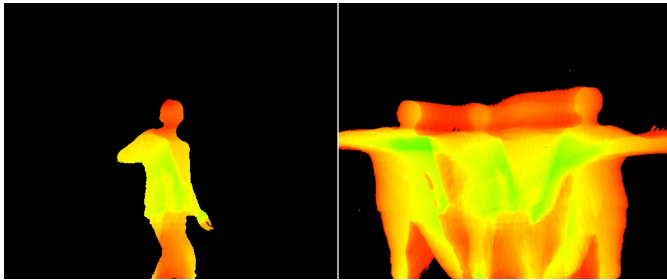


Fig. 3. The You Versus You visualization. Left: the user's movement in real time. Right: the generated output image. This shows a heat map of the locations the user frequents the most in space.

movement and the previous user's movement (Fig. 4). The output image consists of shapes generated by the physical intersections of the current and previous user, with color determined by similarity in the users' body positions. Both visualizations contain a live view of the user's movement and a static output image being generated in real time. You Versus All should also maintain this live image and output image format for consistency.

Dance With Me uses a Microsoft Kinect [6] to capture the following raw data:

- Up to six skeletons (the maximum number of skeletons the Kinect can track at a time) and the x and y coordinates of 25 joints per skeleton, relative to a 512-by-424 pixel image.
- The pixels that correspond to up to six bodies' silhouettes, relative to a 512-by-424 pixel image.

For consistency with the rest of Dance With Me, the You Versus All visualization will only look at the above raw Kinect data. The data set You Versus All should examine is the movement data generated by all people who have used Dance With Me.

While Dance With Me can handle up to six users at a time, it is optimized for one user at a time. You Versus All should also work for multiple users but be optimized for one user.

Additionally, due to technical constraints, the data representing all past users should be reduced to a finite amount of data. Dance With Me is run locally on one computer. As the number of past Dance With Me users grows with usage, to limit the amount of storage space that You Versus All consumes, a limit must be placed on the number of past users whose data is stored at any given point in time. This is further discussed in Sect. 4.5.

A typical user will be completely unfamiliar with Dance With Me. The user will be encouraged to explore You Versus All by moving around and observing what happens, and will be instructed that this

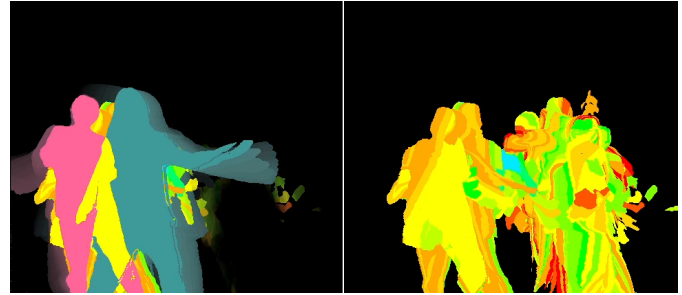


Fig. 4. The You Versus Previous visualization. Left: the current user's movement in real time, played on top of footage of the previous user's movement. Physical intersections are shown in this view for one second before fading away. Right: the generated output image. This shows shapes generated by the physical intersections of the current and previous user, layered on top of each other as they are created. Color is determined by similarity in the users' body positions.

movement will generate artwork. The user's anticipated tasks with You Versus All are thus to:

- **Generate** artwork using body movement.
- **Discover** past users' data by interacting with the installation.
- **Discover** similarities between their movement and others' movement.

3 RELATED WORK

At a given time step, for the current user, You Versus All has access to information about the user's position and location in space, along with information about the history of the user's movement. At all times, You Versus All has access to information about all past users' historical movement and position data. Related work is broken down by the exploration of space and time, and using motion data to generate art.

3.1 Space-Time Cubes

Space-Time Cubes (STCs), first developed by Hägerstrand [2], show trajectories through two-dimensional space and time by using a third dimension to represent time. While this approach was explored for You Versus All, the other visualizations in Dance With Me are two-dimensional, making STCs incompatible with the rest of the installation.

3.2 Capturing Motion Data to Generate Art

There are many examples of motion data being used for artistic purposes. For example, the PoseNet Sketchbook [4] highlights artistic mappings of movement to various outputs, including text, color, and audio. Eternal Dancefloors [1] explores the history of past users by recording movement data for each user, adding this footage to a repository of recordings of previous users, and then playing all of this footage together on repeat. However, none of these examples emphasize a dependence on past users' data or the dependence of future users on the current user's data.

4 SOLUTION

You Versus All allows users to use their movement to generate artwork while exploring past users' data. To do this, You Versus All filters past data by time step and position in space. Specifically, the last 25 users' movement data is filtered by time step and right hand location.

The visualization runs for 20 seconds at 16 frames per second. Each frame is referred to as a *time step*. At each time step, the current user's silhouette and the x-y coordinates of their right hand are identified. You Versus All then attempts to find a past user whose right hand was at the same position as the current user's right hand at the same time step. If a past user is found, the corresponding silhouette is displayed to the user on a live image and is stamped onto an output image; both

of these images are generated and displayed to the user in real time (Fig. 2). After a past user's silhouette is retrieved, that user's silhouette continues to be retrieved for three more time steps. This makes past users' silhouettes continue to move for 0.25 seconds before fading away. This continued movement is referred to as a *trail*. When there are five seconds left in You Versus All, a countdown is shown to the user and the live image fades away until the visualization is over.

At the end of Dance With Me, the user is shown all output images that they generated over the course of Dance With Me, including the one created in You Versus All (Fig. 5).

This solution follows the same live image and output image approach as You Versus You and You Versus Previous. The You Versus All output image is clearly generated using silhouette shapes, which is consistent with the other Dance With Me output images (Fig. 5). This maintains consistency across the installation.

Another solution that was considered was averaging all past users' movement into a single representative past user. This representative user would then be used in a modified version of You Versus Previous as the "previous" user. However, this averaging of silhouette and body position data loses the richness of individual users' movement, and is likely to look less "human" over time. By filtering past silhouettes by time and space, the full You Versus All data set can be explored while keeping the data understandable and meaningful.

In the following sections, I discuss design decisions for You Versus All in greater detail.

4.1 Color

Color is assigned to silhouettes to differentiate the silhouettes from each other. This is done by mapping body position to color at each time step. To make color assignment deterministic from the user's perspective, You Versus All uses the RGB color space and maps right arm position to the red channel, left arm position to the green channel, and leg separation to the blue channel. The higher an arm is raised, the higher the value of the corresponding color channel. The wider the legs are set apart, the higher the value of the blue channel. An example of this is shown in Fig. 6.

The HSV color space was also considered in the design process: saturation and brightness remained at fixed values while arm and leg positions were mapped to different hue values. However, in preliminary testing, the RGB mapping appeared to provide a more straightforward mapping of position to color. While information is being encoded in each of the RGB color channels, it is not important for the user to be able to interpret the color: the color's main purpose is to differentiate silhouettes from each other.

A new color is computed for the current user at each time step. These generated colors are associated with specific users and time steps to determine the color of past silhouette data. However, trails use the color of the initial past silhouette retrieved by the current user. This is discussed further in Sect. 4.2.6.

4.2 Silhouettes

At each time step, the current user's position is used to retrieve past users' data to display on the live image and output image.

4.2.1 Number of Silhouettes Retrieved

At a given time step, You Versus All attempts to find a past user whose right hand was at the same location as the current user's right hand. If multiple past users are found, the oldest result is returned. If no such past user was found, no new silhouette is displayed (Fig. 7). I chose to display one user, and to not search for nearby users if no exact matches were found, because trails and multiple frames per second generate sufficient interactivity in both the live image and output image. This also minimizes lag: during testing, the more past silhouettes retrieved, the slower the visualization performed.

4.2.2 Determining Location in Space

Similarity in space is determined by processing the user's right hand's x and y coordinates and assigning the hand to one of 56 possible locations in space; if a right hand is not detected, the Kinect will infer

a position. The 512-by-424 pixel screen is divided into 56 rectangles. All rectangles are the same size except for the ones on the top and bottom edges of the screen, which are twice the height of the other rectangles. This reflects the lower likelihood of a user's hand being at vertical extremes. A clear example of the right hand being used as a reference point is shown in Fig. 2.

Mid-spine and head positions were also considered as reference points for identifying same discretized locations in space. Using these joints generated more occlusion, as users' silhouettes were more likely to align when using these reference points. However, this occlusion reinforced the idea of past users being at the same place. Ultimately, due to the limited range of potential head and spine locations, the right hand was chosen to generate diversity in past locations.

Because a right hand can often be positioned on either side of a user's body, using this joint as a reference point can lead to unexpected definitions of being at the same location, such as the live image shown in Fig. 8. Additionally, the closer a user is to the Kinect, the larger their silhouette appears. Both these scenarios can lead to the retrieval of past silhouettes whose overall locations in space appear non-similar. This is intentional, and encourages users to reflect on how their movement data will affect future users' experiences with You Versus All. However, for this behaviour to make sense, users may need to be explicitly instructed that their right hand is being used for comparison against previous users' location data.

Changing You Versus All's body reference point to the left hand instead of the right hand would not affect its overall functionality: choosing the right hand over the left hand was an arbitrary decision.

4.2.3 Space and Position Encoding

Aside from median filtering to reduce noise around silhouette perimeters, the shapes and positions of the silhouettes displayed in You Versus All are the exact silhouettes as given by the raw Kinect data. These silhouettes are used as marks that encode past users' location and body position. This provides a direct mapping of movement to screen output.

4.2.4 Time Encoding

The passage of time is shown in the live image by fading past silhouettes away over several time steps. This is done by gradually decreasing the values of past silhouettes' color channels as time passes. This is also done for the current user's silhouette (Fig. 9).

Time data is encoded in the output image by layering silhouettes on top of each other over time as they are retrieved. The oldest silhouettes are at the back of the output image, and the newest silhouettes are at the front.

4.2.5 Shape Layering

The current user's silhouette is always at the live image's foreground to prevent occlusion by previous silhouettes. No additional highlighting of the current user's silhouette is provided. This creates uniformity between the current user and past users, and encourages the current user to perceive their own silhouette as being no different from past users' silhouettes.

4.2.6 Trails

In the live image, after a past silhouette is retrieved by the current user, the past silhouette continues to move for 0.25 seconds before fading away. This shows the trajectory of the past user and highlights how the past user's movement may be similar or different to the current user's movement. To clearly indicate that a displayed silhouette is part of a trail, as opposed to being a newly retrieved past silhouette, trails always remain the same color as their originally retrieved silhouette. The length of the trail is limited by technical constraints: longer trails introduce more lag into You Versus All.

4.2.7 Discouraging Stillness

In order for past silhouettes to be displayed on the live image and output image, the current user's right hand must shift in position by at least 3 pixels in both the x and y directions. This discourages the user from remaining still and reinforces the idea that the user's movement drives



Fig. 5. Output images from Dance With Me. These images are generated in order from left to right. Left: a heat map of how much time the current user spends at a given two-dimensional point in space. Color maps to the amount of time spent at that location in space. Middle: intersections in space of the current and previous user. Color is determined by the similarity of the current and previous users' joint positions. Right: the silhouettes of past users who were at the same place at the same time as the current user. Color is determined by the past user's body position at that point in time.



Fig. 6. An example of mapping body position to color in RGB color space. The higher the right arm is raised, the larger the value of the red channel. The higher the left arm is raised, the larger the value of the green channel. The wider the legs are set apart, the larger the value of the blue channel. This body position, with a raised right arm, lowered left arm, and separated legs, creates a magenta color that indicates large red and blue values and a small green value.

the visualization. This feature was added after it was suggested during the initial round of You Versus All testing.

4.3 Output Image

The output image consists of all past silhouettes retrieved by the current user through space and time. Only the exact silhouettes retrieved by the current user's movement are stamped on the output image: to reduce clutter on the image, no trails are included. Additionally, while the image is generated by the current user's movement over time, the image does not consist of any of the current user's silhouettes. This reinforces the current user's dependence on past users' data and encourages the user to reflect on how future users will be dependent on their data.

A circles and crosses output image (Fig. 10) was also considered. In this output image, circles represent the current user's right hand

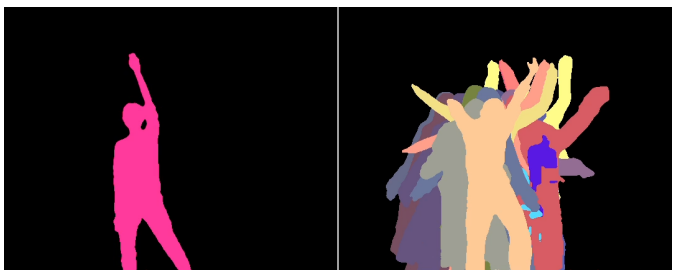


Fig. 7. If no matching past user data was found at a given time step, no new silhouettes will be displayed behind the current user on the live image (left). The output image (right) will not change until a new matching past silhouette is found.

location, crosses represent past users' right hand locations, and color represents body position at that point. As circles take up more screen space in this image, they place more emphasis on the current user's data. However, after testing both potential output images with users, I decided that the silhouette-driven output image was more compatible with the other silhouette-driven output images generated in Dance With Me (Fig. 5).

A space-time cube was also considered as an output image, but this approach was also not compatible with the other output images generated in Dance With Me, and so was discarded as a potential solution before user testing began.

4.4 Concluding the Visualization

Once there are five seconds left in the You Versus All visualization, a countdown timer is displayed at the bottom right corner of the live image. Over the course of the remaining five seconds, the timer counts down and the live image gradually fades into a grayscale image (Fig. 11). This smooths the transitions between the different stages of Dance With Me.

The countdown was implemented after receiving user feedback that a countdown would be useful to help transition between Dance With Me visualizations.

4.5 Data Set Size

You Versus All uses the last 25 Dance With Me users as a representative subset of all past Dance With Me users. This number of users was adjusted over the course of user testing. You Versus All became noticeably slower the larger the database grew. In particular, with more than 50 past users in the database, the visualization began to lag to the point where the live image and output image were not being generated in real time, and this was reflected in user feedback. I observed during testing that reducing the data set to 25 users restored the real-time feel of You



Fig. 8. An example of two silhouettes that do not appear to be at the same place at the same time. The pink silhouette on the right is the current user, whose arms are crossed against their chest. Their right hand's discretized location is identified as being at the same discretized location as the silhouette on the left, despite the two bodies' non-similar overall locations in space.

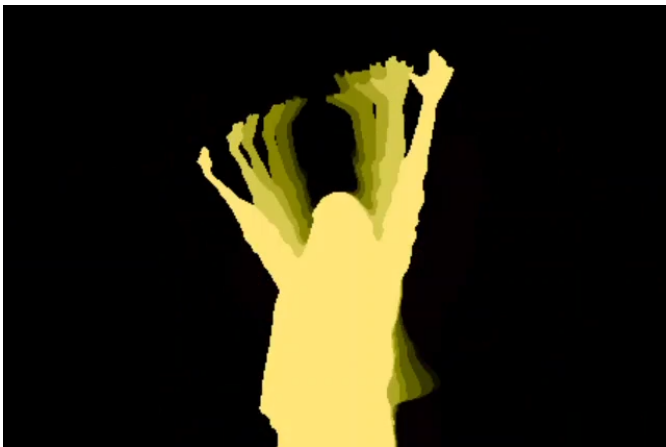


Fig. 9. The current user's silhouette leaves a trail on the live image to give the user a sense of their motion.

Versus All, and that this amount of data was enough to consistently find and retrieve past users' silhouettes.

4.6 Integration with Dance With Me

You Versus All is Dance With Me's third and final visualization. Dance With Me begins by running You Versus You for 20 seconds. You Versus Previous is then run for 20 seconds. Finally, You Versus All is run for 20 seconds. The output images generated from all three visualizations are shown together to the user at the end of Dance With Me, as in Fig. 5. In this manner, Dance With Me takes users on a journey from exploring only their data to exploring many past users' data.

5 IMPLEMENTATION

Dance With Me is implemented using Processing and Java, and uses a Kinect for Xbox One motion sensor to capture body data. You Versus All uses the same languages and hardware. I used the following third-party libraries:

- **Kinect v2 Processing library for Windows** [5] to retrieve raw silhouette and joint position data from the Kinect.

- **BezierSQLib** [3] to use SQLite with Processing.

A local SQLite database is used to store information about past silhouettes' color, position, and time step. The You Versus All database is local to a user's machine, is of finite size, and is only being read by one user at a time. The database contains one table. Each row stores the following information: user ID, frame/time step number, discretized right hand position, red channel value, green channel value, blue channel value, the x coordinate of the right hand, the y coordinate of the right hand, and an array of pixels that represents the user's silhouette. The simplicity of the You Versus All database, coupled with SQLite's minimal setup, made SQLite an optimal choice. A relational database was chosen so that past users could easily be selected and deleted by user ID.

I set up the SQLite database and wrote all the code for You Versus All except for the functions that implement median filtering and the mapping of body position to color. Both of these functions were written by teammates who I am working with on Dance With Me.

6 SCENARIO OF USE

Anna walks through the AMS Student Nest at UBC. She sees a pop-up installation called "Dance With Me", where she hears music playing and sees people dancing around in front of a projector screen. Intrigued, Anna decides to check out the installation.

An installation organizer explains Dance With Me to Anna. For about two minutes, Anna can move around in front of a motion sensor and see her movement projected onto the screen in front of her. Three visualizations will be displayed one after the other in real time. For twenty seconds each, they will visualize the following: similarities within Anna's own movement, similarities between Anna's movement and the movement of the person who used Dance With Me before Anna, and similarities between Anna's movement and the movement of everyone who used Dance With Me before Anna. At the end of the experience, Anna will be shown output images that she has generated from all three visualizations.

Anna stands in front of the projector screen and begins to move around. She is particularly interested in her similarities with everyone who used Dance With Me before her.

Anna notices that as she moves around in space, different-hued figures pop up around her (Fig. 2). After these figures appear, she notices that they continue on their movement trajectories momentarily before fading away completely. Anna remembers that these figures are past Dance With Me users who were in the same space at the same time as Anna. As she continues moving around, more figures appear and fade away wherever Anna moves. She also notices that silhouettes do not always appear around her (Fig. 7). Eventually, Anna notices a countdown at the corner of the screen (Fig. 11), and she realizes that the visualization is almost over.

After the countdown finishes, Anna is shown all the output images she generated (Fig. 5). Anna finds it amusing that she was able to use her body movement to generate art on her own, with a stranger, and with a whole crowd of strangers. She wonders how the next people will use her movement to generate art of their own.

7 EVALUATION

I tested You Versus All in two key stages: first with users familiar with Dance With Me, and then with users unfamiliar with Dance With Me.

In both stages, users were provided with a brief, verbal overview of how You Versus All works. Users were told that You Versus All would be looking for past users who were at the same place at the same time as them, that their movement would generate an output piece of artwork, and that the visualization would run for 20 seconds,

After the user tested You Versus All, the user and I had an informal, open-ended discussion about their experience. In some cases, different variants of You Versus All were tested with the same user, and the user was asked for their preference.

In this section I summarize the insights gained from testing You Versus All.

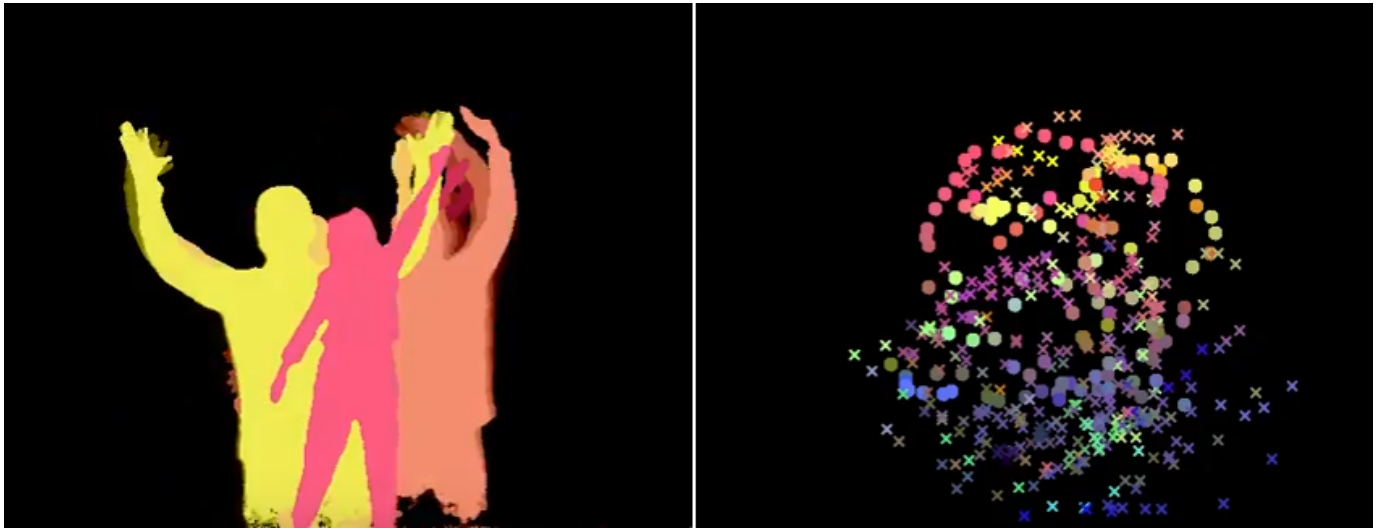


Fig. 10. An example of a circles and crosses output image. Circles encode the current user's right hand location and crosses encode past users' right hand locations. Color encodes overall body position.



Fig. 11. You Versus All displays a countdown once there are five seconds left in the visualization. The live image gradually fades to grayscale. This gives the user a smoother transition into viewing all the output images generated over the course of Dance With Me.

7.1 Stage 1: Feedback from Users Familiar with Dance With Me

I am developing Dance With Me with three classmates. I asked two of them to test You Versus All. Both users thus had an understanding of Dance With Me's goals and how You Versus All fits into the overall project. Both users understood that a specific joint was being tracked to determine similar locations in space.

During this stage of testing, You Versus All was using the head as the reference point for identifying similar positions in time and space. This was found by the test users to be restrictive, and the right hand was suggested as a reference point. This was implemented and tested again with the users; the right hand was strongly preferred as the reference point.

Despite understanding the mapping of body position to color, the users noted that they were not paying attention to their body position. Color appeared to be a byproduct of their movement as they attempted to find past users through space and time.

The users noticed that even when they were not moving, past silhouettes would sometimes appear behind them. This behaviour felt unintuitive and made the users feel like they could not control the visualization. I added a movement threshold that the current user's right hand would have to surpass before past silhouettes would be displayed. Both users strongly preferred You Versus All with this added movement threshold. I tested 1-pixel, 2-pixel, and 3-pixel-sized movement thresholds, and both users felt that 3 pixels was sufficient to encourage movement without being too large a threshold to surpass.

The users noted the replay value of the visualization, as there was a lot of past data to discover.

Both users tested the silhouette-driven and circles and crosses output images, and had no strong preference for either image. However, after this round of testing, I decided to use the silhouette-driven output image for its consistency with the other Dance With Me output images.

After this feedback, the following You Versus All features were carried into the next stage of testing:

- The right hand is used as the reference point for identifying same locations.
- Silhouettes do not appear if a user's right hand appears to be still.
- The output image consists of past silhouettes layered over each other through time.

7.2 Stage 2: Feedback from Users Unfamiliar with Dance With Me

My capstone team and I tested Dance With Me with four users who were unfamiliar with the visualization. In this section I specifically discuss feedback that the users had for You Versus All.

All users thought that they did not have control over their silhouette's color. They expressed confusion around what color represented, and thought that it was a randomly generated value.

Users particularly enjoyed being able to generate output images. Two users mentioned that they would enjoy an album-like summary of all output images at the end of Dance With Me so that they could compare all the output images.

One user mentioned that they found You Versus All to be laggy. At this point, You Versus All contained the data of approximately 50 past users. This lag disappeared after reducing the number of stored past users to 25.

Two users first tried You Versus All with minimal instruction. They were then told that their right hand controlled the visualization. Both

users strongly preferred knowing their right hand was being tracked, as they felt that they had more control over the visualization.

One user mentioned that during their experience, they were unsure of why their data mattered and how it would affect future users, and that it would be helpful to receive an explicit explanation about this before using You Versus All.

Two out of the four users felt that You Versus All had replay value. All users felt that the experience was enjoyable and that it felt like an artistic experience.

After this feedback, the following features were developed for all Dance With Me visualizations, including You Versus All:

- A countdown begins five seconds before each visualization ends.
- At the end of Dance With Me, the user sees all output images they generated over the course of the experience.

Specifically for You Versus All, the maximum number of past users was decreased to 25.

8 DISCUSSION AND FUTURE WORK

In this section I summarize lessons learned, and limitations and future plans for You Versus All.

8.1 Lessons Learned

Design decisions for You Versus All would have been easier to make if priorities for the visualization were firmly set from the beginning of the project. There were many decisions where different choices optimized for either artistic integrity, user experience, or the amount of information being encoded. While the visualization is now being optimized for its user experience, at the expense of the amount of information encoded in the visualization and how closely it follows the premise of “past users at the same place at the same time”, having this goal from the beginning would have helped make firmer decisions throughout the project.

8.2 Limitations and Future Work

While You Versus All is meant to explore the data of all past Dance With Me users, it currently only keeps the data of the most recent 25 users due to technical constraints. In the current implementation, this limit on the number of past users does not appear to negatively impact the user experience. However, it is not truly a visualization of all past users’ data, which makes the name “You Versus All” inaccurate. In the future, I hope to improve the diversity of the data set representing all past users while keeping this data set as small as possible. This may be done by implementing a more sophisticated process for deleting past users, where the database prioritizes having a diversity of trajectories through space. This may also be done by reducing the amount of data being stored per time step. For instance, storing the right hand’s exact x and y coordinates is unnecessary if the ability to generate the circles and crosses output image is no longer needed. This work will hopefully make the You Versus All data set a better representation of all past users.

User testing feedback indicated a strong preference for understanding that the right hand controls the visualization, so I will explore how to make this more intuitive through explicit instructions or a mini-tutorial before You Versus All begins.

While users were not confused by color, users unfamiliar with Dance With Me misattributed color as being a randomly generated value. I will develop an experiment to assign the current user a random color at the beginning of You Versus All. The user’s silhouette will remain this color throughout You Versus All. I will then test both this and the existing color mapping system with users to see which system is preferred. If users are satisfied with a static, randomly assigned color, this may greatly simplify You Versus All and allow users to focus more on their movement through all of space, instead of just their body position.

9 CONCLUSION

I created You Versus All, a visualization for Dance With Me that allows users to generate artwork using their movement data and the movement data of the last 25 users of Dance With Me. This visualization is an art installation that aims to encourage users to reflect on their relationship with the data they generate. For 20 seconds, at 16 frames per second, a Kinect sensor tracks the current user’s movement. At each time step, You Versus All attempts to find a past user whose right hand was at the same discretized location as the current user’s right hand. If a past user is found, their silhouette is displayed behind the current user on a live image and is stamped onto an output image. To reinforce that the user generates artwork using past users’ silhouettes, the output image is displayed to the user again at the end of the entire Dance With Me experience. You Versus All was tested with six users to evaluate their overall experience with the visualization. Their responses were positive and indicated that You Versus All was an enjoyable experience.

REFERENCES

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