Heart of Ballet Project

Feasibility Study

Exploring why ballet inspires us

(The 18-minute read)

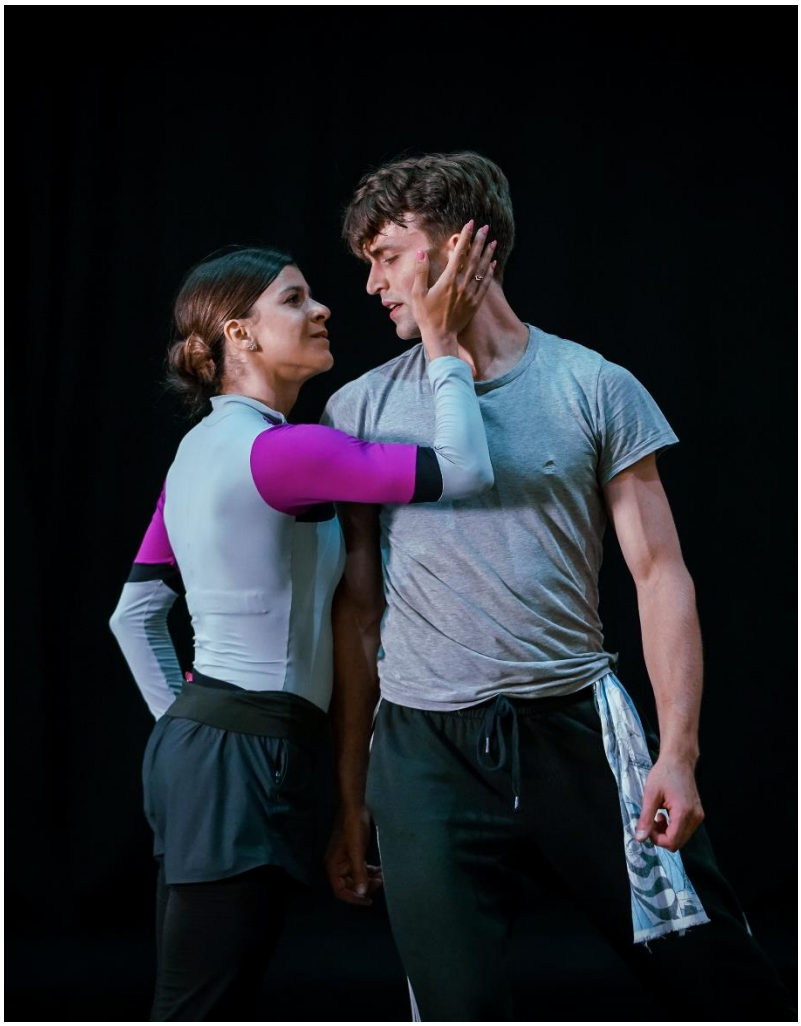
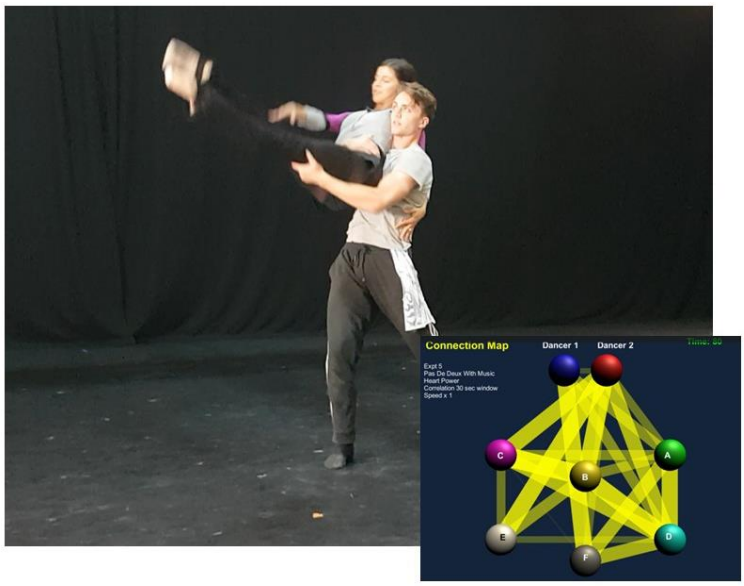


Image: Rosie Collins

A collaboration between Collision Unknown,
Matthew Ball, Mayara Magri and Heartbond

When we allow ourselves to be moved by dance, we can transport ourselves away from our day-to-day worries and travel to a place of inspiration and bliss. We may feel united with strangers in a profound, shared experience and even be brought to tears. This feeling can move us so greatly that we can remember a performance for days, weeks, even years afterwards. It's that awe-inspiring feeling that keeps us coming back to the art form in search of this connection to something greater than ourselves.

It is easy to marvel at the physical skill of dancers. In every performance a professional dancer expects their body to rival the standards of an elite athlete, at the same time as portraying the full range of human emotions. There is a commonly quoted saying, attributed to Einstein, that 'dancers are the athletes of God'. Whilst there is some dispute about whether Einstein did or didn't coin this phrase, there can be little doubt of the power of dance to open our hearts. It was this elusive quality that we set out to investigate.



Matthew Ball and Mayara Magri in action with the inset showing the high degree of synchronisation of heart rate patterns between the audience members and the dancers during a peak moment in the Pas De Deux experiment.

The question that inspired the research

How did *Heartbond* become involved with dancers and the profound feelings that they can create? It started at an exhibition for *The Love Project* in May 2024, where a group of designers had come together to showcase their ideas for products and services that champion human connection. Over dinner we met a member of *Collision Unknown,* an organisation bringing science and the performance arts together in new and innovative ways. One of their directors asked us a question: 'Can you measure the amazing feeling that I have when I watch ballet?' Our answer was yes – we believed we could. Our confidence was based on the fact that we had considerable experience of measuring

the changing heart rate patterns as people experienced a variety of emotions in their relationships.

Background to the feasibility project

'The Heart of Ballet Project' built on the work that *Heartbond* had been engaged in for the last decade. During our research we had used commercial heart rate monitors to study how the heart rate patterns of two people synchronise when they are in a bonded relationship. These patterns are identified from what is called heart rate variability (HRV), a subject that has become the focus of a great deal of academic research which shows that there is a strong link between HRV and positive physical and mental health. To further investigate the synchronisation of the heart rate patterns in pairs of people, *Heartbond* developed a smartphone app to display heart connection in real-time. We used the app on four phones during the feasibility study to measure the HRV synchronisation of two professional ballet dancers and six audience members during a range of dance routines.

Why synchronisation is important

There's been a large amount of research that has shown that human connection is the key to improved mental and physical health. Conditions such as heart disease and stroke decrease when we live a connected life. Other research shows that dementia, anxiety and sleep problems can be reduced by increased connection. In short, we are happier and more successful in life when we have meaningful connections in our relationships.

There's also research that shows that there is a link between physiological synchronisation and relationship dynamics. A lot of this work has focused on monitoring shared movements and activities, which has been shown to drive synchronisation and bring people together. We have listed the major papers that we have reviewed as part of our work at the end of this article for you to read for yourself if you would like to delve into this further.

Our research has taken HRV synchronisation one step further because we wanted to understand how emotions, awareness and focus can affect people's shared heart rate patterns. This has led to some significant discoveries which we wanted to investigate in the world of ballet.

The collaboration

Image: Rosie Collins

'The Heart of Ballet Project' was a collaboration between *Heartbond* (Claire Berry and Peter Granger) and *Collision Unknown (*Tim Duncan, Valentino Zucchetti and Rosie Collins). The three members of *Collision Unknown* and one member of *Heartbond,* Claire Berry, formed the audience for the feasibility experiments, and the team from *Collision Unknown* asked two other people to join them. We were extremely lucky to be able to work with two of the principal dancers from the *Royal Ballet* in London, (Matthew Ball and Mayara Magri). These world class dancers choreographed their own dance sequences for the study including a Pas De Deux that they had created themselves.

How we set up, ran and analysed the experiments

The first thing that we did was to break down the original question into three smaller ones.

In a performance:

1. Do ballet dancers connect to each other?
2. Do the dancers and audience connect to each other?
3. Do the members of an audience connect to each other?

The small audience (6) gathered at a café for a few minutes before going to a rehearsal room. Everyone knew at least one person in the group, but no one knew everyone. We asked the audience to explain the nature of their relationship with the others and how often they attended ballet. This gave us some background information about them and from this we could see that the audience participants had a varied experience ranging from no knowledge of ballet, some who regularly attended ballet, to a ballet dancer and choreographer. We also asked the audience members whether they enjoyed dance, and the answers ranged from no interest at all to those holding a great love for this art form. We were happy that this gave us a reasonable spread of experience and interest in ballet despite the small size of the audience.

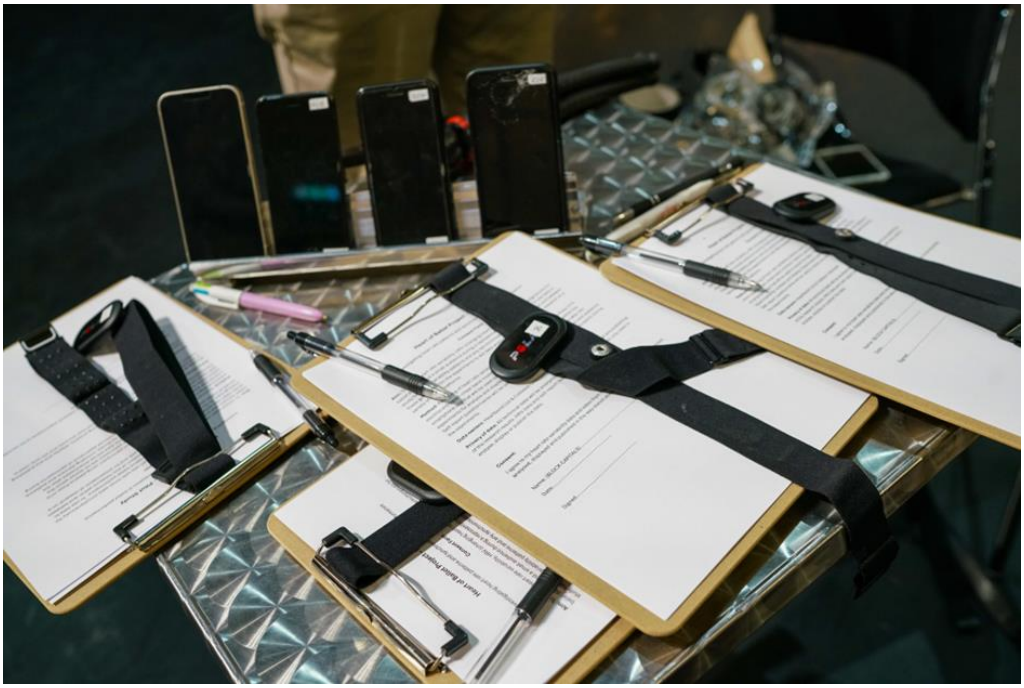
Peter Granger & Claire Berry from Heartbond *(Image: Rosie Collins)*

The two dancers joined the audience for the experiments at the end of a long and hot working day. They are partners in life as well as in dance so we realised from our earlier research that this might have some effect on the degree of heart synchronisation observed.

The experiments were designed to see whether heart rate variability synchronisation would change in different dance scenarios. We were also interested in the most effective dance for connecting the audience. The experiments included dancing separately and together, with and without music, in both practised and improvised routines. The experiments were designed to last for approximately seven minutes, which the dancers had indicated was the maximum length for an intense dance sequence.

The dancers and the audience members were given a self-report sheet before the experiments began, to obtain background information. The pack also included a list of questions to answer before and after each experiment, allowing the participants to summarise their feelings. This feedback gave valuable information about the emotional experiences of the dancers and audience so that we could compare this with the degree of synchronisation of the heart rate patterns.

Every participant was given a Polar H10 heart rate monitor which is worn as a chestband. These are consumer grade ECG heart rate monitors that send the heart rate data to the *Heartbond* app via Bluetooth in real-time. Academic research has shown the Polar H10 compares favourably in terms of quality with medical grade monitors. The heart rates were recorded into the app, along with some analysis for each participant. This was later downloaded to a computer so we could integrate the data for the eight participants and carry out in-depth analysis. We also recorded video footage of the dancers and the audience to allow us to relate participant activity to the heart rate patterns.



The phones and heart rate monitors used to record the data. *Image: Rosie Collins*

Experiment 1: Setting the scene

The first experiment was designed to be a control by minimising the movement of the participants. This was easy to achieve for the audience as they were seated in two rows of three people. The audience were asked not to talk, move or look at each other. This was more challenging for the dancers who needed to move during this time to keep

themselves warmed up. As the dancers gently moved, the audience were asked to look away until the experiment ended.

Experiment 2: Improvised dancing separately without music

For the next experiment the dancers had been asked to dance separately without music, improvising their movements. The dancers chose to focus on circles as a theme for the dance. The audience watched in silence.

Experiment 3: Improvised dancing separately with music

The second experiment using movement, followed quickly on from the first. This time the dancers continued to improvise but the nature of this dance style meant that the movements were different from experiment 2. The dancers, danced separately as before, but this time with music.

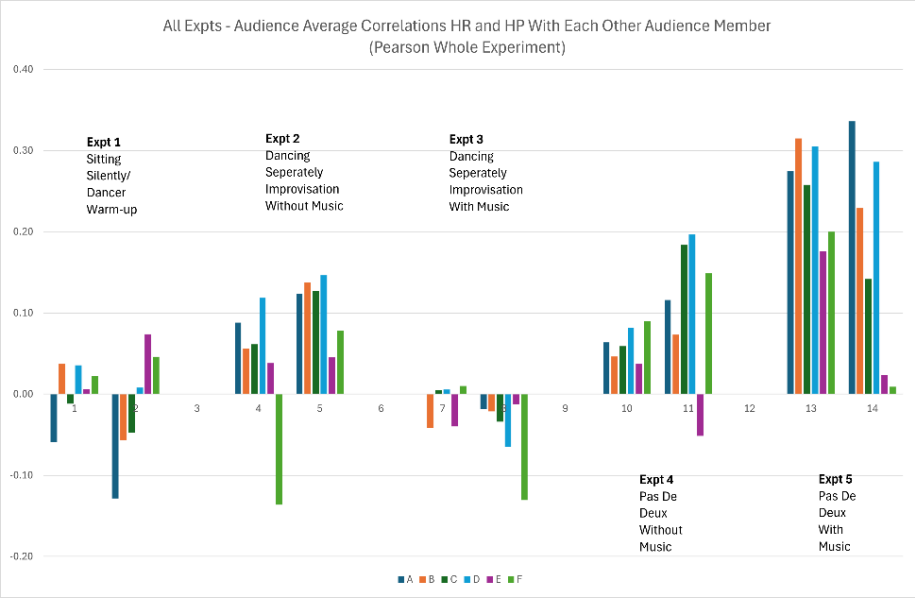
Experiment 4: Practised dancing together without music

This experiment brought the dancers together in a Pas de Deux, that they had choreographed and had previously practised. They danced it without music.

Experiment 5: Practised dancing together with music

The final experiment saw the dancers repeating the Pas de Deux from experiment 4 with the music that they had used in their choreography. This experiment replicated a typical public performance of ballet.

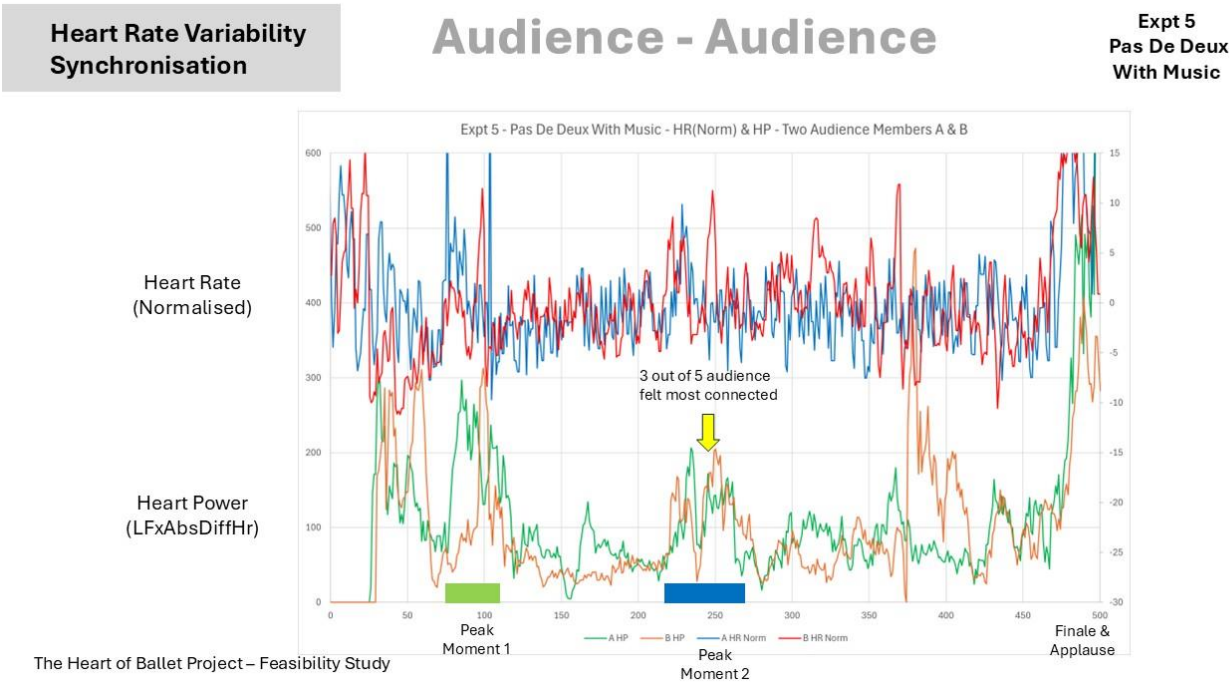
The results



How the audience's hearts synchronise whilst experiencing ballet dancing. Chart shows the average correlation for each audience member during the five experiments – notice how there is a striking increase in synchronisation during the Pas De Deux with music experiment and decrease in the improvisation with music.

Key findings from the data and self-report:

1. Every member of the audience left the experiments reporting a feeling of being more inspired than when they had arrived.
2. The dancers showed synchronisation, despite the challenges of measuring heart rates during intense exercise.
3. At times during the experiments, the audience connected with each other, often in complex clusters and with varying durations.
4. During 'peak moments' in the dances we observed distinct group synchronisation where most, if not all, members of the audience synchronised.
5. The dancers and audience connected with each other, again in a complex way.
6. The experiment that had the highest synchronisation and positive self-report was experiment 5 (practised Pas De Deux with music).
7. The experiment that had the least synchronisation, and negative self-report was experiment 3 (improvised dancing separately with music)



Example of the heart rate patterns of two audience members synchronising while they watched the Pas De Deux with music experiment. This was most noticeable during peak moments in the dance and the same patterns were often seen for the other audience members during these periods.

What we believe the data and self-report means

Our study has shown clear evidence of synchronisation of heart rate patterns between dancers and audience members during a variety of performances. We found that the

synchronisation of heart rate patterns was backed up by the self-report from the dancers and the audience, suggesting that feelings of inspiration, enjoyment and connection can be measured in real-time.

It was interesting that during experiment 3, when the dancers were physically disconnected and reported low levels of connection with each other, that the audience broadly felt the same.

The overall increase in synchronisation and positive self-report that was observed with the final Pas de Deux, shows the power of dance to bring people together in a shared positive emotional experience. We wondered whether the narrative of this dance, that was based on feelings of love; lost and rediscovered, coupled with the strong connection of the dancers, was the cause of the strongest synchronisation seen during the research experiments.

We also suspect that there is a group effect, particularly during peak moments in a dance where many or all hearts move into synchronisation and in such situations that the dancers and audience can inspire each other. This could have implications for the dismantling of the 'fourth wall' (the perceived communication barrier between performers and an audience) . It is apparent that inspiration is not a one-way process.

Where might the research take us in the future?

We are aware that this was a small-scale feasibility study to determine if there was merit in measuring heart rate variability synchronisation in dancers and audiences. After spending time reviewing the results from our experiments, we were delighted to discover that our findings were more significant than we had hoped. It is clear that not only is it possible to measure heart rate variability in ballet dancers and audience members, but that the synchronisation of these measures can give great insight into performance effectiveness and enjoyment. In the future, it would be wonderful to work with larger groups and to work with dancers and an audience whilst watching a ballet live.

We would also welcome the opportunity to work with others to seek replication of what we have found. This includes broadening out into other areas of the performing arts, and groups of people from other walks of life where connection is key.

Where could we improve?

Most small-scale studies are likely to come across unexpected findings or problems, and this study was no exception. There were many variables in our experiments that could have affected heart synchronisation, and we appreciate that this limits the

conclusions that can be drawn from the study. Future experiments should control for these variables.

Additionally, we would improve the way that heart rate recordings are collected from the dancers as their athleticism and very high heart rates (up to 190 bpm) during the dances meant that some data was lost and there was some question as to how we might split out the exercise element of heart rate variability from that which was caused by the emotions. Whilst we could use the heart rate data to spot synchronisations when the dancers were moving slowly or at rest, the data from periods of high exertion were less reliable. This issue needs further research.

The power of applause was a factor that we hadn't considered before the study. When the audience started to clap appreciatively, we observed, perhaps not surprisingly, a very high level of synchrony. As we did not have the time to explore this effect in detail, we cannot comment about whether this was due to the connection that the audience and dancers felt through the acknowledgement of the performance quality or because of the physical action of clapping in unison. We would recommend a specific study of applause and its impact on heart synchronisation, as this could inform performance design and audience interaction.

It was interesting that those with the most familiarity with ballet showed the most synchronisation. This has posed extra questions for us. We feel that this factor might be interesting for dance companies that are looking at ways that they can reach out to new audiences and in the future. We would be interested to explore this further.

Our experiments produced a richer dataset than we had expected. To allow us to interpret the data more effectively, we would look at ways of recording self-report throughout the experiments, as well as at the start and end.

We are already developing new software that displays changes in synchronisation between dancers and audiences in real-time. Not only could this help choreographers and coaches monitor their teaching effectiveness, but it also opens a door to innovative ways to connect and engage audiences with an immersive experience displaying their connection to each other as a dance unfolds.

Final thoughts

Drawing our thoughts together, we believe that the greater the connection that dancers and audience feel to one another, the greater is the synchronisation of their heart rate patterns and the greater their enjoyment of the dance.

Using the heart rate data and self-report, we believe that the elusive feeling that opens our hearts and connects us to something greater than ourselves, is easily accessed

through the experience of ballet. In this small but fascinating study we feel that we have measured the 'magic of ballet' and begun to understand why we can be moved to tears by dance and other forms of art when experiencing it collectively. We believe that the study of heart rate patterns and synchronisation opens the door to a wide range of applications in ballet development and the performing arts as well as other applications where groups of people come together in a common purpose.

Our thanks

The Heart of Ballet project received support and time that was generously given by Matthew Ball and Mayara Magri, Tim Duncan, Valentino Zucchetti and Rosie Collins. Our thanks also goes to the two audience members who helped us with the study. We are very grateful to them.

Working with these professionals has given us a glimpse of the potential to move dance forward in new and exciting ways.

Useful references & further reading

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Report created by Claire Berry & Peter Granger

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