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Synaesthesia and Cycling Data Art: Towards Cross-Modal Representations of Self-Tacking Cycling Data

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Synaesthesia and Cycling Data Art: Towards Cross-Modal Representations of Self-Tacking Cycling Data

This paper develops ideas around cycling as art practice. The questions at the heart of it revolve around how new data technologies enable us to represent such experiences as artworks. Recent research in neuroscience has begun to establish the ways in which modes of perception are processed in the brain. Related research suggests that Synaesthesia may be caused by a genetic mutation that results in a ‘cross wiring’ of these modes of perception. Within the arts there is a long history of exploration around synaesthesia, ideas that are becoming relevant again particularly in relation to the growth in personal data. Representing sensations and transferring them from one mode to another offers a way to handle some of this data and potentially say new things about our experiences. The author explores these ideas through artworks made using data from cycling to investigate the visualisation of this experience.

Keywords: Generative Art; Data Art; Cycling; Synaesthesia

Introduction

This paper is an extension of previous work that has explored and documented the development of ideas around cycling as art practice in some detail. Particularly, this earlier work provides much necessary background to this paper in terms of establishing the artistic rationale and protocols for which there is not enough room to explicate here (O’Neill 2016, O’Neill 2018, O’Neill 2019a, 2019b). The premise outlined in these earlier papers is that such a practice is only made possible by the advent of self-tracking tools that have extended the boundaries of similar practices (e.g. walking art, generative art, etc.) that are highly influential to this work (O’Neill 2018). Moreover, the combination of cycling and self-tracking tools works as an assemblage of technologies that create and mediate a particular experience of landscape that has hitherto been largely unexplored or represented through art forms (O’Neill 2019a). This experience is phenomenological, embodied and esoteric. The questions at the heart of the practice revolve around how new technologies enable us to represent such experiences as artworks for others to engage with, given that “An object cannot compete with an experience”, as Hamish Fulton put it (Fulton, 2001). As a result, the gathering and representation of data through self-tracking technologies becomes the central research focus of the work. The kind of data that is gathered has an effect on what can be represented; therefore the investigation requires the exploration of a range of data types that relate to different modes of experience. Some are exteroceptive (visual and auditory), others are interoceptive (heartrate) and others still proprioceptive (body movement). It is the combination of such data that provides the opportunities for novel forms of representation through art practice. With that a range of questions emerge around cross-modal transformation and the synaesthetic communication of data within the context of a rich multimedia saturated life. It is this specific aspect of my developing arts practice that are addressed within this paper.

Cross Modal Processing and Synaesthesia

In recent years a great deal of interesting research has investigated modes of perception within the context of neuroscience, much of which has been surveyed by Gemma Calvert (Calvert, 2001; Calvert and Thesen, 2004). This research aims to establish the ways in which distinct perceptual phenomena are processed in the brain, particularly the ways in which the brain matches and integrates different streams of sense data. For example, seeing, holding, smelling and tasting a banana all produce different sense data but the brain is able to integrate these different data streams into a consistent experience of reality. Moreover, if one set of sense data is eliminated then using the others will still establish the same coherent experience. E.g. Establishing one is eating a banana while blindfolded is still possible even though you can’t see it. This ability to integrate sense data even where gaps in the input appear provides us with a robust mechanism for making sense of the world around us. These functional neuroimaging studies have shown that this is made possible because certain areas of the brain that are responsible for individual sense information are linked to areas of the brain that deal with multiple forms of sense data. Not only that but these networks are distributed around the brain in different locations and different networks operate at different times depending on the data input. E.g. the audio/visual neurological network is slightly different from the visual/tactile network, which again is different from the somasomatic/audio network and so on. Interestingly though, research is beginning to reveal that certain areas of the brain feature in these networks more than others with specific roles in cross-modal processing: Areas such as the superior temporal sulcus, the insula and the superior colliculus for example (Calvert et al, 2000; Calvert, 2001). Perhaps most interesting is that neuroscience is beginning to reveal how the ordinary brain structures of the perceptual system are interconnected in complex ways in order to enable us to make sense of what we see, touch and hear and that perceptual data is not simply processed in a linear ‘sense specific’ fashion in only one part of the brain.

Arguably, one of the most interesting areas of neuroscience that is looking at perception is that focused on understanding synaesthesia. Again recent studies provide invaluable insight into the relationship between cross-modal sense studies and synaesthesia (van Leeuwen et al, 2016). Interestingly, Ramachandran and Hubbard (2001a, 2001b and 2003) have proven without doubt that synaesthesia is indeed a perceptual effect and not a cognitive or memory driven experience, as was once thought. In a similar vein to the cross-modal perceptual studies, synaesthesia research has used brain-imaging techniques to establish the locations of stimulation when subjects are having synaesthetic experiences. Findings have established that synaesthesia is likely caused by cross activation in neurons in adjacent areas of the brain, which are responsible for slightly different perceptual or cognitive activities. Ramachandran et al have proposed that this may be down to genetic mutation that results in dysfunctional pruning of neural linkages as the brain develops. This in turn is reinforced by learned experience, which cements connections in the brain between normally unconnected areas. This points towards a resolution of the debate between the 'unity of the senses' thesis and the opposing 'modular thesis' camps (van Campen, 1999, Casini, 2017). Ramachandran and Hubbard go on to suggest that this mutation could be quite common and spread throughout brains in a patchy way across both lower perceptual and higher cognitive functions. They also contemplate the role this may play in understanding metaphor, creativity and the development of language. Additionally, they also suggest that this distributed patchy 'cross wiring' of the brain is why we see more examples of synaesthesia in artists, poets and other creative people. This work is extremely interesting in relation to the production of creative work. Indeed, within the arts there is a long history of exploration around the concept of synaesthesia, which has driven many artists to produce their greatest work.

Synaesthesia and the Arts

Early experiments by musicians and artists in the 18th century saw attempts to connect colour systems to notes on musical scales through Pythagorean theories of harmony and Newton's ideas about the frequency of light and sound waves (van Campen, 1999). Goethe's romantic theories of correspondence between colour and sound were also influential. Mostly it was musicians and composers that were driving this exploration (Berman, 1999; van Campen, 1999). However, in the visual arts it was Vassilly Kandinsky that initially developed these ideas. In his 1911 essay "On the Spiritual in Art", heavily influenced by Goethe, Kandinsky sets out his description of synaesthesia (specifically seeing colours when hearing music) as a phenomenon whereby one mode of experience is transposed, automatically to another (Pieperhoff, 2009). Interestingly this is very similar to the most recent scientific studies on the subject. For Kandinsky though, this type of experience was spiritual, one that heralded the possibility of seeing beyond the veil; of experiencing higher realms through all the senses. He believed art had a responsibility to emulate this experience in order to enlighten others to a deeper spiritual reality beyond our senses. His paintings became more and more abstract as he sought to find harmony and dissonance through colour much like composers do with music.

Other early 20th century artists also experimented with the relationship between music and colour. Robert Delaunay, Paul Klee and Piet Mondrian were all influenced by, and influential in promoting, the idea that art and music were deeply linked (Pieperhoff, 2009). Many of their paintings explore ideas of colour as pitch and rhythmic pictorial structures that emulate the structures of music. Additionally, in the early half of the 20th century artist using film and animation as a medium, most notably Mary Ellen Bute, Oskar Fischinger and Norman McLaren, explored these ideas in more depth (Naumann, 2009). Around this time art became increasingly self referential, the works of the Concrete Artists, for instance, eschewed abstract figurative content in favour of painting only about painting. Mathematics and Geometry taking centre stage in the construction of art works. These ideas have already been, and continue to be, influential on the author's work in relation to pictorially visualising data (O'Neill, 2018).

Gesamtkunstwerk

During this time, Kandinsky dreamed of bringing all the arts together, music, painting, dance and literature to create the ultimate artwork, the Monumentalkunstwerk, the closest thing an artist could get to representing a full blown spiritual experience to the senses. The ‘Yellow Sound’ was his attempt at doing so, an ambitious project that was never fully realised in his lifetime. The concept of the total artwork was not a new idea. In the 19^{th} century Wagner had a similar dream of turning his opera into a Gesamtkunstwerk, where all the arts worked together to produce a performance that enlivened all the senses. Before film really took over, the opera and the theatre quite naturally became the home for this cross fertilisation of ideas between media and although the concept of synaesthesia perhaps drifted to the background, the desire in artists to relate different art forms together never went away. Bauhaus teachers Oskar Schlemmer and Lazlo Moholy-Nagy did a great deal to reconfigure the idea of what theatre was and what its components were, foregrounding spatial structure, light, sound, colour and movement as much as performance.

Intermedia and Multimedia

After the demise of the Bauhaus, at the hands of the Nazis, It is well documented that these ideas were continued at Black Mountain College, under the direction of Joseph Albers. (Brody et al, 2002; Harris, 2005 and Molesworth, 2015). Students such as composer John Gage, artists Robert Rauschenberg and Kenneth Noland, and dancer Merce Cunningham all studied there among others. In turn, these artists themselves had a huge impact on the New York Art scene in the 1960s, influencing the development of the Fluxus movement and Conceptual Art in general.

During this period a great deal of radical art making took place that challenged the norms of art practice by mixing practices together. Cage composed music by mixing Buddhist teachings with compositional notation strategies. Alan Kaprow established Happenings that were collaborative multimedia events and Dick Higgins invented the term ‘intermedia’ to help theorise what was evolving in terms of interdisciplinary art practice. Intermedia in actual fact is quite distinct from multimedia in that it is formed by crossing the boundaries between media to form a new kind of outcome, whereas multimedia requires no boundary crossing just multiple media all represented simultaneously. [Film is the perfect example of multimedia as kind of gesamtkunstwerk, moving images, sets, locations, lighting, actors, dialogue, music all working together in harmony to simulate an experience that tells a story.] Importantly, while much of this era is described as chaotic, a rough logic of structure vs. content emerges as the framework where one mode of making work becomes the vehicle for structuring another and vice versa, e.g. using sculpture to make poetry, dance to make painting, art to make music etc.

Arguably, the ideas of multimedia/intermedia really took hold when digital technology and the internet gave them a home. Think simply of the convergence of media in our computers or mobile phones and you get the picture. How many Facebook pages contain text, photographs, video content, music or graphic design all present at the same time? What was once avant-garde art practice has now become commonplace. We live in a multimedia infused environment now, that we take for granted. Almost like McLuhan’s goldfish, we are no longer aware of the medium we live in until we are taken out of it (McLuhan, 1994). This is echoed in what are now long standing media art festival events such as Ars Electronica, ISEA and the Transmediale festival, which have explored many of these themes through multimedia art over the last 30-40 years. Indeed, another generation of computational artists that benefitted from the conceptual art of the 60s and 70s have been hugely influential in this field. People like, Roy Ascott, Paul Bown, Ernest Edmonds, Frieder Nake. (Boden and Edmonds, 2009; Franco, 2018). Clearly there is still something fascinating about crossing the boundaries of different art practices and perhaps this is related to our native cross-modal perceptual capacities.

Interestingly, Edmonds in particular makes a nod towards early synaesthetic art practices in his own work, when he talks about the relationship between generative visual art making and the structure of music (Edmonds, 2003).

Rationale for Making Work

Increasingly, ideas of synaesthesia and intermedia are becoming relevant again particularly in relation to the growth in personal data that is effecting our digital lives. As we generate more and more sophisticated types of data we need more and more sophisticated ways of handling it. Information overload is never far away and reading through lists of numbers on spreadsheets is not the way forward. A language of data visualisation has developed, some of it through experimentation with digital tools and others informed by theory, for example Bertin's Semiology Graphique (Bertin, 2011). Largely though what we have are complex (sometimes) interactive graphs that provide layers of information that can be interrogated in multiple ways or elegant colour coded diagrams that help explain complex situations (McCandless, 2009, 2013). It's all about navigating the information. It's all about the speed of processing and it's all about consumption. Not very much of it is about the experience of being or the sensation of an experience, which is why looking back at early explorations of synaesthesia are interesting within this context. The early synesthetic experiments of Kandinsky in particular explore the affects of rendering cross-modal sensations in relation to promoting an awareness of the potential for an emotional/ecstatic/spiritual experience beyond the realms of the everyday sense data. This is not something the author claims of his own work. However, the rationale that making art, which deals with trying to represent the sensations of experience, can offer a sense of that experience to others is not only appealing but highly contentious. We know that the realm of the spiritual is an esoteric experience reserved for the few that have worked to become enlightened and by its very nature it defies representation (Cage's use of the I-Ching is a good example).

In truth, the same can be said of any experience. One cannot transfer the totality of an experience to another through a singular channel. Not even words come close. Even using multiple modes of communication may fall short. In reality, if two people experience the same event, both will have different perspectives on such an event and therefore each experience will be different. It is impossible to get inside the head or body of another being and experience what they experience and yet we try to communicate our experiences constantly. The similarities between our heads and bodies in terms of species and culture have allowed us to develop habits and technologies that enable us to distribute information between us about our experiences. We can represent, emulate even simulate experiences in highly sophisticated ways that get closer and closer to a sense of experience. However, we can only transfer elements or aspects of an experience to one another in the hope that others may recognise such a representation as something they have experienced themselves elsewhere. This provides us with a sense of validity a sense of sharing and a sense that we are not alone.

The ability to represent sensations and transfer them across from one mode to another is an extension of this thinking. The pioneers of this idea, inspired by tales of genuine synaesthesia saw this as something quite miraculous; Something that transcended the boundaries to higher planes of consciousness. In the midst of a multifaceted, multimedia drenched digital life even an authentic experience is arguably a rare occurrence, let alone a spiritual one (O'Neill, 2009). Maybe this is because the kind of media we use is only able to represent certain aspects of our experiences and due to the proliferation of the multimedia environment that which is excluded is often forgotten about. Perhaps interest in Synaesthesia, Intermedia and cross-modal representation offer the potential to challenge the norms of media representation?

Perhaps, like Kandinsky and his early experimental music/painting, we can explore the opportunities of data across different modalities to provide alternative views on our experiences beyond those we have grown accustomed to.

Methods & Materials

The strategy and practice of gathering data from the field is discussed in more detail in (O'Neill, forthcoming). Suffice to say that the process of automatically self-tracking data while cycling is the same. This requires either two iPhones or one iPhone simultaneously running two data capture apps. The two phones method is much more reliable in terms of battery life and data storage whilst in remote environments.

Cyclemeter, is the app used for capturing all the information about the journey: GPS route mapping, speed, altitude, heart rate (with the addition of an HR sensor), distance, average speed etc. Datalogger is the app used for capturing the body motion data. Strapped to the author's lower back, it uses the iPhone's inbuilt accelerometers to capture six degrees of motion, acceleration and gyroscopic force information. The rate of data capture can be customised across a range of frequencies so some very fine detailed information can be captured. The author experimented with this to begin with but finally settled on a rate that could be synchronised with the Cyclemeter data, more on this shortly.

Calibration

Once the data has been captured and cleansed (extraneous unused data has been removed, e.g. average speed, total distance etc.) and calibrated (start points located) the data is drawn into custom made Processing patches and used to form the visualisation. The Cyclemeter data is used in exactly the same way as the author outlines in his previous paper (O'Neill, forthcoming) i.e. the speed, altitude and heart rate data is manipulated in Processing to correspond to different RGB colour channels that are then mixed to fill the output shapes put on screen. The motion data, however, is used to determine the number of shapes put on screen, their x, y position, size (z) and the timing of their rendering. Initial experiments used a set timing sequence based on previously established principles from stripe paintings (O'Neill, 2016) i.e. 1 stripe equals one minute, and a rough estimate that their are around 10 GPS points within each stripe. However as the author worked with the motion data and experimented with its frequency it was possible to tune this. In fact this became a crucial part of synchronising the data flow between the two data sets. Essentially, the first set controls the shape and colour of the visualisation and the second controls the timing and position. However, the timing of the motion data must start and end in synchronisation with the colour data, something that proved to be highly problematic.

There is no easy way of synchronising the start of the data capture on each iPhone app. One invariably always starts before the other and finding a common connecting point within both sets of data proved to be extremely difficult. An easy solution would have been to find corresponding time-stamped data points in each set. However, each device handles this stamping in a different way, neither of them making it easy to find or manipulate. As yet, the author hasn't found a suitable solution to this issue. Suffice to say the synchronisation of data between apps is part of the data cleansing process that manages to approximate the start points in both sets through some careful ad-hoc pen and paper arithmetic. For example, if there are 100 points of motion data in a minute then 100 shapes will appear in sequence at different points on screen determined by xyz coordinates within that minute. However, the colour of the shape will only change every minute.

Shape

The decision to use circles instead of stripes or full screen colour changes may seem arbitrary but there are several reasons for this. Firstly, previous data paintings by the author (O'Neill, 2018 and O'Neill 2016) used stripes to layout the sequence of data across a 'canvas' or screen that provided a picture of all that data at once, essentially shifting time related data to visualised space, like plotting a graph. Thus the data can be read from left to right top to bottom like a written page or taken in at a glance in its totality. The author felt that time revealed data should feel like a head-on experience just as cycling itself is a head on experience of moving forward along the road/trail. So the decision was taken to reveal that data layer upon layer in the centre of the screen. Circles and squares were both considered as potential forms to render and experiments were explored to see how they looked. However, being influenced by both the walking artists and by the concrete artists, it became clear that the circle had a certain resonance with those practices, which echoed connections to them and other artists that have used it. Most notably the use of the circle invokes references to Richard Long's stone circle, and the paintings of Kenneth Noland and Jasper Johns.

Process

The process of developing the outcomes was an incremental heuristic one where creative solutions to the problems of shape, size, position, timing, speed of render etc. were all explored through a non-systematic holistic approach. In other words it was acknowledged that even though the author might be working on one aspect of the solution e.g. experimenting with relating z data to size, the timing of the drawing of the data my have an impact on how it looks. Similarly, the colour and opacity of the background would have an equal effect on the colour and opacity of the circles. Thus, the author had to move between various variables as necessary in order to produce a holistic visual solution.

Results

This next section presents the results of the experimental outcomes. It is broken down into 3 sections. The first deals with shape, size and timing based on speed, altitude and HR data only. No body motion data was included in the initial proof of concept stage. The second section shows examples of what happened when x, y, z motion data were introduced to the mix and discusses the complexities of this. The third section provides examples of a second iteration of shape exploration i.e. moving away from the circle to explore more complex outcomes.

Initial Tests: Size and Time

Figure 1. (a and b) show two screen grabs from a short experimental sequence of circles Target Practice 1. The x, y coordinates of each circle are fixed to the centre and each circle in the sequence is then drawn one on top of the other. At this point in the exploration timing was not so important as establishing a protocol for presenting discrete pieces of data on screen one after the other in a linear fashion. Size, however, was of great importance as size had the power to shape what was seen on screen at any given moment. In the initial experiments every circle was drawn on top of the previous one and nothing was removed from the screen. This resulted in target style images, reminiscent of Kenneth Noland’s target paintings from the 1950s. The problem was that the sensitivity of code tended to produce circles of only two or three sizes and sometimes a larger circle would obliterate what was previously rendered on screen. In itself there is nothing wrong with this. Indeed, leaving things on screen and over painting them can be considered an aesthetic strategy that is explored throughout this

work at different stages of development. It is also a strategy that is true to the data, in that everything remains on screen whether over painted or not. This makes sense when the resultant outcome is viewed in its entirety from start to finish. Related to this idea of truth to data was the concept of time. How long should each piece be? Should they be an instant result of all the data rendered on screen all at the same time or should the data be revealed one by one at a slower pace. Early on the decision was taken to reveal each circle, as it's own unique point in time within exactly the same timeframe as the author took to complete the cycle run. In other words, a circle at 33mins on screen is equivalent to a data point in time and place 33mins into the bike ride. This shifted the focus from producing static paintings (e.g. stripe paintings O'Neill, forthcoming; 2016) to producing animated 'paintings' that evolve over time on screen. This truth to data then can be seen as a cross-model visualisation of speed, altitude and heart rate data over time.

Figure 1 (a and b) Target Practice 1, (c and d) Target Practice 2.

Figure 1. (c and d) show two screen grabs from a later example, Target Practice 2. Here, the same principles of centrality, over painting and truth to data still apply. However, shifting to a grey background and experimenting with its alpha channel produced an interesting effect that pushed previously drawn circles into the background while letting you see they were still there. To increase this effect the alpha channels of the circles themselves were also set to a level of transparency. This resulted in what appeared to be a shifting and growing central circle that was constantly changing size and at the same time leaving traces of its past on screen. This was a very interesting development as rather than trying to be true to the data by documenting the whole journey it shifts the focus to a particular moment in time and those that have just preceded it. In this, there is something remarkably similar to the focus of attention in cycling. The cyclist constantly has to be attentive to the road in front of him/her and yet there are always traces in the mind of what has just happened in the previous few seconds up until that point. It's like short-term memory holding onto the experience, which fades from view, as perception over writes it with new sense data. So the target on the screen becomes a surrogate for the focus of attention, which in itself holds the attention of a viewer. Arguably, this is more true to the experience of cycling than to the documentation of the journey. Again this became a recurring question throughout the development of the work and appears in various examples during the period.

Adding Body Movement Data: Manipulating the XYZ Axis

With the principles of size, shape and time reasonably well established the software experiments moved to introduce additional body movement data into the mix. The rationale for doing so was that using this data should give an even more embodied sense of what the internal experience of cycling was like than just the speed, altitude and heart rate data of previous works. Linking with ideas established around the notion of focus, attention and short terms memory that were evoked in the initial experiments the aim was to use the body motion data to affect the on screen circle as if it were the body of the cyclist. Thus the effects of road/trail surface, bumps, jolts and vibration would become visible on screen. In the spirit of staying true to the data the centre of the circle would represent the centre of the cyclist and any motion of the body would be transferred to the x, y and z coordinates of the circle on screen. X and y coordinates were fairly straight forward as they were relatively easy to translate directly to the x and y coordinates of the screen. It was the z coordinate that became the initial focus of experimentation.

Figure 1 a) Grow Circle, shows a screen grab depicting huge variations in circle size from the very small magenta dot in the centre to the large violet outer circle. Calibrating z motion data proved to be tricky. First of all, the decision was made to link z data with the depth of the picture plane. Up until then the screen had largely been seen as a flat 2 dimensional space. Experiments with size and transparency had begun to shift this as the circle could be seen to be changing size but also moving backwards and forward in depth on the screen. As z data represents acceleration forwards and backwards of the author's body on the bike it seemed logical to replicate this on screen. The key to this was in establishing the extent of that pseudo three-dimensional axis, as well as the centre point relative to the screen. By looking at the data itself, it was easy to see that there were three essential components to it. Firstly, there was positive data, i.e. data that could be used to visualize forward body motion. Opposing this there was negative data, i.e. data that could be used to visualize backward body motion and finally there was neutral data. i.e. data the was registering close to almost zero, i.e. no z axis body movement. Extrapolating this to the screen meant that positive data had to be related to bigger size circles, negative data to smaller and zero data to relatively stable sized central circles. This was established in the software by setting the stable circle size first relative to the screen size. Then, the negative data had to be identified, turned positive, multiplied to exaggerate its size and made negative again to be subtracted from the size of the stable zero data. Finally, the positive data had to be multiplied and added to the stable zero data. The result is a stream of data that changes size relative to a fairly stable circle size on the centre of the screen and gives the impression of a circle that is moving forwards and backwards on the screen in pseudo three-dimension space.

Figure 2 a) GrowCircle b) ReverseSunday c) ComrieCircle 1 d) ComrieCircle 2

Once z axis motion was established, the experimental focus shifted to working with x and y data. Figure 2 (b and c) show screen grabs from two separate experiments, Reverse Sunday and Comrie Circle that exemplify the parameters of experimentation. Essentially, following the principle of multiplication established with z motion data, the same ideas were executed on the x and y data. Figure 1 b. shows an example where the multiplication of the data has been minimal, in other words the distance of circle centre points drawn in relation to the screen centre, or zero point is very small, thus there is very little movement on the x,y axis and the circles tend to stay grouped centrally. Contrast this with Figure 1 c. where the multiplication of the data is much more extreme. Here the position of the circles are much more varied on screen revealing more movement on the x,y axis. The rationale for multiplication is simply that the x,y,z data provided by Data Logger is given in very small units. As a result when rendered without multiplication it is almost invisible, as it doesn't correspond with the scale of the screen. Several iterations of multiplication were explored to establish something that felt right. In the end though the problem was resolved by calibrating multiplication to screen size so that central size of circle, and x,y,z motion all became scalable in relation to the size of the screen being drawn on.

Figure 2 d. Comrie Cirlce 2 shows the final outcome of this phase of experimentation. Returning to a black background and reinstating the alpha settings from previous experiments results in a fluttering semi transparent circle that moves randomly around the screen in a highly erratic manner, changing size and colour as different terrain affects body motion as well as speed, altitude and heart rate. This piece is a reworking of the stripe painting Comie Circle, discussed in a previous paper (O'Neill, forthcoming).

Pushing the Boundaries of Shape

Circles are by far the simplest shape to use in these experiments but as the work progressed, moving between visualising the totality of the data and trying to communicate a sense of experience, it became apparent that shape too could be pushed in a new direction. Just as colour and coordinates could represent data, so too could the parameters of shape.

Figure 3 a) Star Ball 1 b) Icy Lour 1 c) Icy Lour 2 d) 3D Sphere

Figure 3 a. shows a complex star shape the parameters of which are controlled by the usual data. The overall size of the star is controlled by z motion data. The length of the spikes is controlled by a division of z data, which changes the size of the inner circle in relation to the overall size. The number of ‘spikes’ is controlled by heart rate data, the higher the heart rate the spikier the star.

Many different iterations of shape configuration were explored as can be seen in Figure 3 c and d. Here all the data is being laid on top of one another again in order to see what the totality of motion data and shape configuration looks like. The size and spikes of the stars are being controlled by a combination of speed and heart rate, which gives a very different effect. The outcome is like watching a pulsing diffused ball of coloured light emerge and evolve from the screen. Figure 3 d. on the other hand is a completely different experiment that looked a representing the same sort of data through Processing’s native 3D visualisation tools. The idea of a sphere was a natural extension of the circle. Generally the same principles applied the z data controls the size of the ball, altitude, speed and heart rate control colour. Speed also controls the number of polygons on the sphere. However, x, y and z data was also used to control pitch roll and yaw of the ball. The result is a central sphere on screen that twists and turns on the spot getting larger and smaller as well as changing colour as the data runs its course through the software. This is a much closer representation of the motion data in that it depicts the twisting and turning aspect of motion rather than the raw acceleration. However, despite this particular aspect of truth to data, it is a relatively static representation and doesn’t do a great deal in terms of representing the feeling of cycling. These experiments remain unresolved, as there are many other parameters and effects to explore. Suffice to say that what is now driving them is the desire to represent something more of the felt experience of cycling that has emerged in some of the other explorations.

Discussion

The artistic experiments with data visualisation as described above are essentially an attempt to grapple with the idea of how to express the esoteric experience of cycling through self-tracking data. The experience of cycling is multifaceted. It is a full blown, full bodied, embodied and embedded experience of being in the world extended by technology. The bicycle is both an enabler and a constraint that allows the cyclist to use his body in a highly efficient manner to travel large distances but at the same time restricts his movement to essentially forward motion in one position. The experience of cycling then is one of effort and speed, which is deeply interlinked with the environment in which it takes place. Indeed the terrain and weather conditions of the environment directly affect the cycling experience, sometimes in extreme ways (O’Neill, 2018, 2019a). The author is acutely aware that data visualisations of the sort described here get nowhere near representing the totality of such an experience. However, the exploration is not really about trying to replicate the cycling experience but to investigate how data from such a real world experience can be used to create art that aesthetically expresses some of the experience that is usually hidden. It is relatively easy to take photographs of people cycling. Indeed, coverage of professional cycle races is commonplace on TV. While these do a good job capturing exoteric experience of cycling from the observer’s perspective, very little has been done to explore the esoteric aspects of that experience from an insider’s perspective. The experiments presented here aim to do just that. Through exploring the various combinations of data types and visual forms, elements of size, shape and timing, the author has sought to develop a kind of language of expression that remains true to the data while at the same time trying to get at some kind of representation of felt experience. To this end the works can be seen as a kind of pseudo-synaesthetic experience where data is transferred from the physical world of the cyclist to the visual world of the artist. As discussed at the start, it has been shown scientifically that genuine synaesthetic experiences are caused by a cross wiring between adjacent parts of the brain that are responsible for dealing with different sense data. Moreover, this cross wiring can be diffused throughout the brain and can link perceptual with conceptual brain processes. Taking this outside the brain we find that cross-modal art works have existed for quite some time, over 100 years now, and that artists have been exploring the idea of synaesthesia, particularly music and painting in some detail. Arguably, it could be claimed then that cross modal art works or intermedia art, are akin to a cultural version of synaesthesia. They take information from one medium and transpose it into another. In the past this tended to be restricted to interdisciplinary work across the boundaries of say music and art, dance and art, music and poetry etc. (as discussed already). However, with the advent of more sophisticated self-tracking tools and rich data sets there are growing opportunities to explore the intermedia between very different domains. Cycling and art is just one of them and the experiments presented here represent the first foray into such new interdisciplinary territory.

To this end, some of the works are less successful than others. The work on exploring shape for example, has not made great bounds in terms of exploring 3D representations, but then again perhaps that is not the right mechanism of expression. Similarly, the question of whether to represent all the data on screen at once or to reveal and remove parts of it over time has been perplexing to the author. Both have their merits and both say something different about cycling. One is more thorough in terms of representing the whole journey while the other is perhaps better at representing the changing nature of the experience moment by moment as you move through the landscape. One additional thing that has begun to emerge from this work, that is not discussed here is the need for a soundscape. As the works have progressed into animated films, some of them hours long, the need to move away from ‘silent movies’ becomes a real issue. Large-scale projections of work can work as visual pieces on their own in a gallery setting, or on screen as ‘ambient art works’ However, there is an opportunity to explore sound in a more interesting way. Given the synaesthetic nature of the works it is logical to pursue this course. The same data that drives the visualisation can also be used to drive a ‘sonification’ of the experience. It is highly likely that the author will be exploring this avenue in future, perhaps building audio/visual installations that hark back to the earlier days of synaesthetic arts exploration.

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