The Arts in Psychotherapy 65 (2019) 101595

Contents lists available at ScienceDirect

The Arts in Psychotherapy

journal homepage: www.elsevier.com/locate/artspsycho

Loops and Jazz Gaps: Engaging the Feedforward Qualities of Communicative Musicality in Play Therapy with Children with Autism

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ARTICLE INFO

Keywords:
Play Therapy
ASD
Intersynchrony
Communicative musicality
Motor control
Autism
Sensorimotor intentionality

ABSTRACT

Consideration is given to the hypothesis provided by Trevarthen and Delafield-Butt (2013) – that disruption of social synchrony in autism is rooted in disturbance of prospective motor control for expressive action and active perception of other's expression: crucially, autism is a disturbance of "sensorimotor intentionality" (Delafield-Butt & Gangopadhyay, 2013). The feedforward qualities of communicative musicality (Malloch & Trevarthen, 2009) – the temporal motivation and organisation inherent in *pulse* and *vitality* – are taken as foundational for a series of therapeutic principles developed here. The aim: to support disrupted prosocial "intentional movements" by overlaying, integrating, and piggy-backing on intact rhythm and vitality imported, in the moment, from cross-modality experiences – to imbue a child's actions with forward looking organisation and impulse to interact. These principles are illustrated in the form of mini case studies, taken from real play therapy sessions. Certain key concepts are introduced, including: the use of rhythm as compelling structure, the 'jazz gap' as temporal catalyst, the calming and engaging effect of inter- synchrony, and the vitality-matching of a child's emotive and motoric patterns.

Introduction

Recently, a creative group of scientists invited children – some with Autism Spectrum Disorder (ASD), some neurotypical – to play a game on a smart tablet (Anzulewicz, Sobota, & Delafield-Butt, 2016). The game supported intelligent algorithms which recorded, analysed and learnt from each child's touch screen gestures as they played the game. With this information alone, the algorithms could diagnose autism to a 93% accuracy (ibid.). Why would a measure of motoric gesture be so central to a diagnosis of autism?

In the core reference paper for this article, Trevarthen and Delafield-Butt (2013) provide a rich and diverse evidence-base for a developmental psychobiological hypothesis of ASD. This hypothesis roots autism in early growth errors in core brain-stem systems during foetal development. An influence which spans these core brain-stem systems has potential to disrupt the neural integration essential for the temporal organisation of prospective movements, autonomic self-regulation, and regulation of the developing neocortex (Rodier & Arndt, 2005; Rodier, 2002; Trevarthen & Aitken, 1994; Trevarthen, 1999). Trevarthen and Delafield-Butt (2013) explored the potential mechanisms by which these early brain-stem influences may result in disturbance of prospective motor control, including the control needed for expressive action and active perception of other's expression. Crucially here, ASD is seen as a disturbance of "sensorimotor intentionality" (Delafield-Butt & Gangopadhyay, 2013).

In this paper, consideration is given to the detailed parameters of the above hypothesis and a series of therapeutic principles are developed in response. The feedforward, temporal qualities of communicative musicality (Malloch & Trevarthen, 2009) - the motivation and organisation inherent in *pulse* and *viatlity* - are foundational for these therapeutic principles. The aim: to support disrupted prosocial "intentional movements" by overlaying, integrating, and piggy-backing on intact rhythm and vitality imported, in the moment, from cross-modality experiences - to imbue a child's actions with forward looking organisation and impulse to interact. These principles are illustrated as mini case studies, taken from real life play therapy sessions. Certain key concepts are introduced, including: the use of rhythm as compelling structure, the 'jazz gap' as temporal catalyst, the calming and engaging effect of inter-synchrony, and the vitality-matching of a child's emotive and motoric patterns. Play therapy support for children with ASD will always involve input across two main domains: Firstly, *the underlying structures and motives of communicative musicality in play*; Secondly, *the psychological content of a child's emotional life and play*. The first domain is where we connect with a child and is the interactive foundation for

A play therapist's response to: Trevarthen, C., & Delafield- Butt, J,T. (2013). Autism as a Developmental Disorder in Intentional Movement and Affective Engagement. *Frontiers of Integrative Neuroscience (7)*: 49.

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https://doi.org/10.1016/j.aip.2019.101595
Received 16 May 2018; Accepted 6 October 2019
Available online 09 November 2019

progress in the second – it is the focus for this paper.

Autism and Movement

"Movement is the generator and regulator of animate experience… *a child*… can engage effectively with the world and explore its properties only through muscle activity that is regulated purposefully in body-related time and space, and with affective appraisal of its risks and benefits."

Delafield-Butt and Trevarthen (2017), p5.

For children with ASD, disturbances in prospective motor control influence the generation of single action units (such as reaching for an object) and of 'action chains' (where action units are organized in series to perform complex tasks Trevarthen & Delafield-Butt, 2013). In both cases prospective motor control involves, "precise coordination of muscle actions that are conceived…"ahead-in-time" so that they achieve a desired future effect efficiently" (ibid. p8). This coordination can be described as *self-synchrony* : the temporal (rhythmical) integration of multi-modal sensory information required for the translation of an intended goal into a synchronous movement experience which effectively reaches that goal *and* embodies and communicates inherent intentionality. From early infancy, children with ASD present with disturbances in self-synchrony (Tordjman et al., 2015; Trevarthen & Delafield-Butt, 2013). In a reach-to-grasp task, for example, autistic individuals did not rhythmically coordinate the reaching of the arm and the opening of the fingers in a fluid intentional flow – instead they performed one act and then the other separately (Mari, Castiello, Marks, Marraffa, & Prior, 2003). Neurotypical children coordinate the sequence of arm and hand actions fluently in "pre-reaching" and gesturing from early infancy (Trevarthen & Delafield-Butt, 2013)

"The progressive planning of "action chains" communicates intentions… When we see someone grasping a bottle, for example, the initial reaching movement of the arm differs depending on whether the goal is to shelve it or to serve some wine… The postural preparation of the body and extension of the arm, with shifts of gaze, are adjusted from the start in different ways depending on the final goal. Children with ASD have deficits in this preparatory coordination for motor sequencing or action chaining… Typically developing children, when asked to perform an object manipulation task, such as turning an upside-down drinking glass right-side up, adjust their body posture at the start of the action so that their final posture is comfortable… Children with autism begin with a comfortable posture and conclude it in an uncomfortable one, suggesting a deficit of motor "knowledge" of how the action will proceed" (ibid. p8).

I was playing with a four year old boy with ASD this morning. He was sitting in a sand tray. In his right hand he held a spade; in his left, a cup. I watched as he used the spade to dig sand from a pile at his feet, bring his right hand over to the cup in his left, and attempt to pour the sand from his spade into the cup. His initial digging posture left his gaze, torso, shoulder, right arm and wrist in conflict with pouring the sand accurately, but he could not adjust his whole-body patterning fluently in a motion pre-empting the need to pour, neither did he bring the cup to the spade. The result was unfortunately inevitable - each time he missed the cup with the sand and was sad.

The Anticipatory Rhythms of Relating

> "First we must conceive the natural inner constraints or motives of musical behaviours… We have to stop thinking of music forms as physical objects of auditory perception and cognition – as if we would ever be capable of understanding music if all we could do was hear the sounds in it… We have to look to, and listen for, the original generative forms of the impulse to express the dynamic patterns of our minds in communicable forms. We have to recall what happens when music is made" Trevarthen,1999, p. 159.

Stern (1999, 2010) described the flows of communication he observed in early infant-parent play as though the partners were dancing. Colwyn Trevarthen and Stephen Malloch have described early play in terms of a shared flow of musical gesture and timing between partners – in terms of *communicative musicality* (Malloch, 1999; Malloch & Trevarthen, 2009; Trevarthen, 1999; Trevarthen & Malloch, 2000). Such musical *inter-synchrony* involves intricate layers of prospective, forward-looking movement control. In neurotypical play these layers unfold seamlessly through patterns of mutual-regulation which are unconscious and effortless for both partners. It is here, in the dance of inter-synchrony, where a primary disturbance in anticipatory, expressive movement control becomes a significant social disability for children with autism.

Human beings have internal biological clocks, "clusters of rhythmically pulsing neurons that keep time for living organisms, regulate metabolism, procreation, movement, communication and even the temporal nature of human thought" (Osborne, 2009, p.545). Our bodies equip us with biological imperatives to feel patterns of time. Our creative social behaviours are underpinned, organised and compelled into the world through self-generated rhythmic pulses and patterns – rhythms which synchronise our movements and set the blue-prints for anticipating the movements of other people (Malloch, 1999; Malloch & Trevarthen, 2009; Nicholas et al., 2007; Papoušek, 1996; Tordjman et al., 2015; Trevarthen & Aitken, 1994; Trevarthen, 1999; Trevarthen, Delafield-Butt, & Schögler, 2011). Autism has been described as a, "disorder of biological and behavioural rhythms" (overview - Tordjman et al., 2015). There is strong evidence for two impacted "clock genes" (related to social timing) in individuals with ASD (Nicholas et al., 2007). It is highly likely that deficits in organized intentional movement observed in the fine-motor and social development of children with autism are, in part, underpinned by high-frequency oscillator deficits in the cerebellum - where the two impacted "clock genes" manifest as disorder (Nicholas et al 2007; Trevarthen and Delafield-Butt, 2013; Wimpory et al., 2002).

The goal of this paper is to describe and illustrate a series of therapeutic principles which utilise the feedforward qualities of communicative musicality. The aim of these principles: to support disrupted prosocial "intentional movements" by overlaying, integrating, and piggy-backing on intact rhythm and vitality imported, in the moment, from cross-modality experiences - to imbue a child's actions with forward looking organisation and impulse to interact. We need a feel for the parameters of communicative musicality (*pulse* and *vitality*) and the musical forms (*narratives*) they take. Malloch and Trevarthen (2009) described prosocial *pulse* both in terms of biological pattern generation *and* in terms of the related behaviour produced: "Pulse is the regular succession of discrete behavioural steps through time, representing the "future-creating" process by which a person may anticipate what might happen and when" (Malloch, 2017, p. 65). *Vitality* is the term Stern (1999, 2010) gave for the energetic, flowing impetus of human movement – an impetus with inherent intention which underlies the dynamics of motion, interaction, and emotion. It is through patterned flows of pulse and vitality that playful communication takes on a *narrative* – a rhythmical, energised narrative containing an inherent need for progression, heightening and/or completion through action (Malloch & Trevarthen, 2009; Papoušek, 1996; Trevarthen, 1999; Trevarthen & Delafield-Butt, 2013; Trevarthen & Malloch, 2000). Malloch and Trevarthen (2009) suggested that the structure of play narratives may be thought of as a 'classical four-part evolution of a story' – through Introduction, Development, Climax, and Resolution. When Stern (1999, 2010) reflected on his early observations of healthy infant-mother play he noticed that this play was defined by vitality contours involving a shared heightening of excitement with a clear ending in resolution. Brazelton, Koslowski and Main (1974) outlined the key phases of such narrative contours: Initiation; Orientation; Acceleration; Peak of Excitement; and Deceleration. These contours are defined by temporally-organized changes in facial expression, quality of

eye contact, touch (changing patterns of position, intention, and intensity of the body) and vocalisation (changing patterns of rhythm, timbre, pitch, and volume in voice) (Malloch & Trevarthen, 2009) and "…allow adult and infant… to share a sense of sympathy and situated meaning in a shared sense of passing time" (Malloch & Trevarthen, 2009, p. 4).

Within play, contoured narratives take place across two bandwidths of time. There are micro-contours: "…syllables and phrases in speech and song, or dancing steps and gestures, which correspond with arm and hand grasping for object manipulation, or of the head and eye rotations that perform visual inspection. These range from the median syllable frequency of 1.5–3 per second— the same as a running or fast stepping, a glance or eyebrow rise, a laugh or a hand wave— to every 3–5 s for a visual scan, a manipulative sequence, a phrase of speaking or song, and a cycle of deep breathing. These are somato-motor coordinations that achieve use of the environment and pick-up of information for perception, or of a communicative message, in the "psychological present," the "here and now" of consciousness in action" (Trevarthen & Delafield-Butt, 2013, p.7). These micro-contours are the building blocks of interactive play and *protoconversation* (Bateson, 1979). Then there are, "…slower periods of sensed vitality, as expressed in the "extended present" of an episode in a story, or a verse of singing (Trevarthen & Delafield-Butt, 2013, p.7). These contoured narratives occur in bands of 10 to 25 seconds.

There are also longer tides of rhythm fundamental within dialogue, song and co-regulation in play with infants: "Longer times of imagined activity and narrations form natural elements of 25–50 s in the rhythmic verses, playful or calming, of baby songs in all languages… These slower events are identified with autonomic events that regulate arousal, hunger and wakefulness throughout life, and regulation of the rate of heartbeat and breathing by the vagal nerve" (Trevarthen & Delafield-Butt, 2013, p.7).

It is through temporally organised patterns of movement that we reach out to other people for interaction. It is only through temporally organised movement that we can anticipate and begin to understand the intentional communication of other people. As discussed above, infants with ASD are limited in their capacities for temporally organised movement. As such, infants with ASD are limited in the ways in which they reach out to the world, in their anticipation of the intentional movements of other people, and in the expression of novel, creative behaviour.

In a study involving micro-analysis of home video tapes of two infant monozygotic twins, Trevarthen and Daniel (2005) described the significantly different motor and communication patterns presented by a neurotypically developing girl at 11 months and by her autistic twin sister. In a game with her father, the neurotypical twin displayed age-appropriate body awareness, movement control, motor reflex patterns, anticipation, emotional response, intentional engagement with her father, and synchronous social timing. This twin and her father shared three successive narrative contours (18 seconds, 19 seconds and 22 seconds) which structured their play. The experience for the neurotypical twin is characterised by the following felt experiences: being in-sync with her father (they share a synchronous, mutually-regulated pulse beat to their interaction and a flowing contour of vitality, anticipation, intention and enjoyment); the *feeling* of inter-synchrony (the feeling of deep okayness felt by two people when they are flowing in-sync); a sense of wholeness in body-image (the multi-modal, mutually-regulated experience stimulates and supports the infants body- image and contributes to the integration of her sense of motoric, body, and emotional wholeness); a sense of agency; and a natural movement of playful creativity.

In the equivalent game, the autistic twin presented with none of the motoric or communicative qualities described above. Instead, that attempted interaction was defined by more frequent periods of physical stimulation from the father (the only context eliciting a response from the twin) with no social, shared narrative whatsoever.

Autism, Closed Loops, and the Possibility of Creative Relating

Therapeutically I have long been working with a sense of 'closed loops' of behaviour in autism. The feeling is that of a repetitive circular pattern of activity, with its own internal energy, degree of meaning and momentum - yet that momentum seems to lack the motivated organisation for extending meaning-making and/or for reaching out to others. These closed loops can be seen displayed by many children with ASD as repetitive movement patterns, gestures, play configurations, relational patterns, or spoken phrases (Bailey, Phillips, & Rutter, 1996; Sigman & Capps, 1997; Volkmar, Paul, Klin, & Cohen, 2005). Here is a simple introduction to a looping piece of play from a session with Ben, a five-year-old boy with ASD[1] :

Ben is sitting near the edge of the play room. He has pushed five trains up to the wall in an ordered line. Ben touches each train in turn – first on the engine, then the smoke-stack, then the carriage. He then reverses each train a little, in turn, and then pushes them back up to the wall, again in order. Ben then starts again.

Without the feedforward organisation and impulse needed for social anticipatory behaviour, any self-generated impulse for novel exploration of the world is limited and directed towards non-human objects (and/or *humans-as-objects*) (Maestro et al., 2005; Trevarthen & Aitken, 1994). The suggestion here is that 'closed loops' are presentations of behavioural rhythmic pulses disconnected, wholly or partially, from an organised interface with other people – i.e. disconnected from prospective motor control. Closed loops are non-human narratives. Rooted in brain-stem disturbance within foetal development (Akshoomoff, Pierce, & Corchesne, 2002; Delafield-Butt & Trevarthen, 2017; Rodier, 2002; Trevarthen & Delafield-Butt, 2013), defined primarily as disturbances in prospective motor control (Delafield-Butt & Trevarthen, 2017; Trevarthen & Delafield-Butt, 2013) tuned to an over-specificity due to axonal pruning within neuronal overgrowth in the first year of life (Corchesne, Carpenter, & Akshoomoff, 2003), and reinforced as behavioural compensations to early challenging experience – these closed loops can present as chronic and rigid.

The title of this paper implies the possibility of engaging the feedforward qualities of pulse and vitality in the behaviour of a child with ASD. Here it is proposed that these qualities can be imported from cross-modality experiences. Once integrated into a loop of behaviour, these qualities can then piggy-back the loop into an open prosocial interaction - a true game. The suggestion is that, although often presenting as chronic and rigid within autistic begaviour, loops retain the potential for change, novelty, and prosocial impulse. Children with autism have the ability to feel the base-palette of emotions (Bailey et al., 1996; Volkmar et al., 2005), they cannot be defined by disorders of attachment ('attachment insecurity' is co-morbid across the population to differing degrees, but not aetiologically core) (Rutgers, Bakermans-Kranenburg, van Ijzendoorn, & van Berckelaer- Onnes, 2004), and within individually limited parameters they have the *potential* to enjoy and develop rhythms of interaction (Acquarone, 2007; Daniel, 2017; Greenspan & Wieder, 2006; Robarts et al., 1998; Trevarthen, 2001; Trevarthen & Malloch, 2000; Wigram & Elefant, 2009). Within this potential rests the therapeutic premise of this paper.

Where to Start?

The above premise suggests that creative impulse (a "reaching out into the world") remains potent within each autistic child's perceptual interaction with a highly individualised, non-human environment. It is here, meeting within these loops, that we need to begin and build a playful therapeutic relationship.

[1] 'Ben' is a composite case bringing together examples of play from work with several children with ASD. Details in all examples in this chapter have been altered to ensure complete anonymity of all involved.

A useful example to consider here is the phenomenon of *echolalia*. Within the speech patterns of children with ASD, the term 'echolalia' refers to looping, repetitive phrases often copied from television, games etcetera (Volkmar et al., 2005). The meaningful and therapeutic significance of such patterns are often overlooked. The sense is that these phrases are rote learnt and repeated parrot fashion without significance. My experience is to the contrary. It is precisely the regularity of this communicative patterning that tells us that these phrases and contexts *are* significant. Why these phrases and not others? Why this context and not another? I worked closely with an autistic teenager over two years, as he told, re-told, and re-moulded a traumatic experience from his early childhood. Every phrase he spoke, every image he created, and every representation of a feeling was carefully crafted from the dialogue, context and images of computer games he had played throughout his childhood. The book, *Life, Animated* is a beautifully told account of how an autistic child's world opened up in response to his father's dedication to becoming relevant within that child's echolalic context (Suskind, 2016).

As we move on to build social interactions from the direct context of a child's presenting loops, the hope is that these interactions will piggyback on the creative pulse inherent within the looping narrative. As such, this therapeutic play could have the potential to stimulate further self-generation of novel behaviour for learning in a manner beyond simple behaviourist stimulus- response. Learning in this way will lead to motivated, prosocial, and generalisable behavioural response.

Towards a Play Therapy of Musicality for Children with Autism

In the introduction to this paper, it was suggested that play therapy support for children with ASD will involve input within two main domains: Firstly, *the underlying structures and motives of communicative musicality in play*; Secondly, *the psychological content of a child's emotional life and play*. In what follows, a series of therapeutic goals are identified, developed and illustrated all within the first of these domains. These goals are derived from combining insights from the prospective movement control hypothesis of ASD (Trevarthen & Delafield-Butt, 2013), the parameters of communicative musicality (Malloch & Trevarthen, 2009), and from my therapy practice. Certain key concepts will be introduced, including: the use of rhythm as compelling structure, the 'jazz gap' as temporal catalyst, the calming and engaging effect of inter- synchrony, and the vitality-matching of a child's emotive and motoric patterns. Through an understanding of the parameters of communicative musicality we, as therapists, can work within the underlying rhythmic flows of *pulse* and *vitality*. This enables us to engage with sensitive 'direction'[2] at a level non-conscious for the child. And if, simultaneously, we respect and engage the content, characters, and symbolism of a child's play we will remain child-focussed for the child in his immediate, more conscious experience – we will retain the power of a non-directive play therapy approach, which has been shown to support children with ASD (Carden, 2009; Daniel, 2008; Josefi & Ryan, 2004; Kenny & Winick, 2000; Mittledorf, Hendriks, & Landreth, 2001; Morgenthal, 2015; Ray, Sullivan, & Carlson, 2012; Salter, Beamish, & Davies, 2016).

Goal. To share and invigorate the flow of pulse and vitality currently within a child's loop (bringing social significance and inter-synchrony to define the "psychological present"):

- embody the pulse (rhythm) – sound effects, simple matched movement patterns, synchronous physical contact
- embody the vitality – whole-body gestures, emotional sounds, contoured vocal inflection
- respect and connect with the content, characters, and symbols of the play
- use a child-specific combination of sensory modalities[3]

Facilitating inter-synchrony requires us to join in with a child's experience, moving with him through flows of pulse and vitality, whilst respecting his experience by not taking over, shocking, or overwhelming the play. We need to be able to do this through various sensory modality combinations. The concept of Vitality Matching is so helpful for us here (Stern, 2010; Stern, Hofer, Haft, & Dore, 1985). As mentioned above, 'vitality' describes the nature and intensity of energetic expression in human action and communication (Stern, 1999, 2010). Patterns of vitality can be 'matched' through any sensory modality – the shapes and contours of vitality 'mirrored' in essence. We can play with this idea in two ways. Firstly, when Stern talks of 'attunement' he is describing, 'matching and sharing dynamic forms of vitality, but across different modalities" (Stern, 2010, p.42). For example if Ben made a loud staccato shout, I could make a quick, double-footed stomping jump on the ground. If he punched out at the air with a closed fist, I could make a loud but blunt "huuugh" sound full of energy. Secondly, we can explore vitality-matching within the same modality – usually here within the modality of vocal sound. For instance, if Ben is anxiously moaning when feeling frustrated I could make mixed-pitch, rising in inflection, bubbling sounds alongside him which match the increasing energy contours of his vocalization but which hold none of the anxious vibe. Vitality-matching is a conscious process to connect on a level more fundamental than emotion.

In Diagram 1 Ben develops a loop of play, in which he moves his arm through the sand tray, into a new loop involving a slithering snake. In Loop A, I vitality-match Ben's enjoyment of his arm movement through the sand. After a few iterations, our synchronous connection stimulates spontaneous eye contact and then creative play from Ben – creative play which I can then build on through further vitality matching in Loop B and onwards.

Goal. To overlay and integrate an additional layer of rhythm to that inherent in the initial loop (to help stimulate and scaffold an anticipatory, creative impetus):

There is often a natural rhythmic potential to repetitive play. We can draw on this, and make it more immediate and shareable, by adding a layer of embodied, vocalized rhythm ourselves. I have hummed and rocked to accompany wobbling pigs, added a beat-box to the shunting

[2] Even such sensitive directive therapeutic input should, I feel, be introduced with consideration of the rule of thumb: 'Follow- Lead-Follow' (Hughes, 2011). Time and sensitivity should be given to *following* each child's way of being before attempting a sensitive *lead*. It is then instantly back to *following* again in response to the child's immediate communication.

[3] The essence of inter- synchrony shared over time is amodal and can be facilitated through any combination of sensory modalities (Malloch & Trevarthen, 2009). For instance, if a child prefers not to connect with facial expression, eye gaze and/or prefers to be the one to initiate any physical contact in play (as is primarily the case for Ben) then I will support inter-synchrony primarily through matching Ben's experiences with my voice (*his* experience of changing patterns of timbre, pitch, and volume). I will also match with my whole-body gestures (*his indirect* experience of changing patterns of position, intention, and intensity of the body) in the hope that a level of information is possible through peripheral vision. As our connection develops, I will also use clear facial expression and judge appropriate timing for elements of touch (*his direct* experience of changing patterns of position, intention, and intensity of the body). I have chosen this profile of sensory modality preference for Ben as, in my experience, it represents the average for children with ASD. I have also worked with children with ASD whose primary preference is a combination of movement and touch (Daniel, 2017). Here, the amodal aim of sharing narratives of pulse and vitality over time remains the same but the play work becomes similar to a session of dance- movement psychotherapy (Trevarthen & Fresquez, 2015).

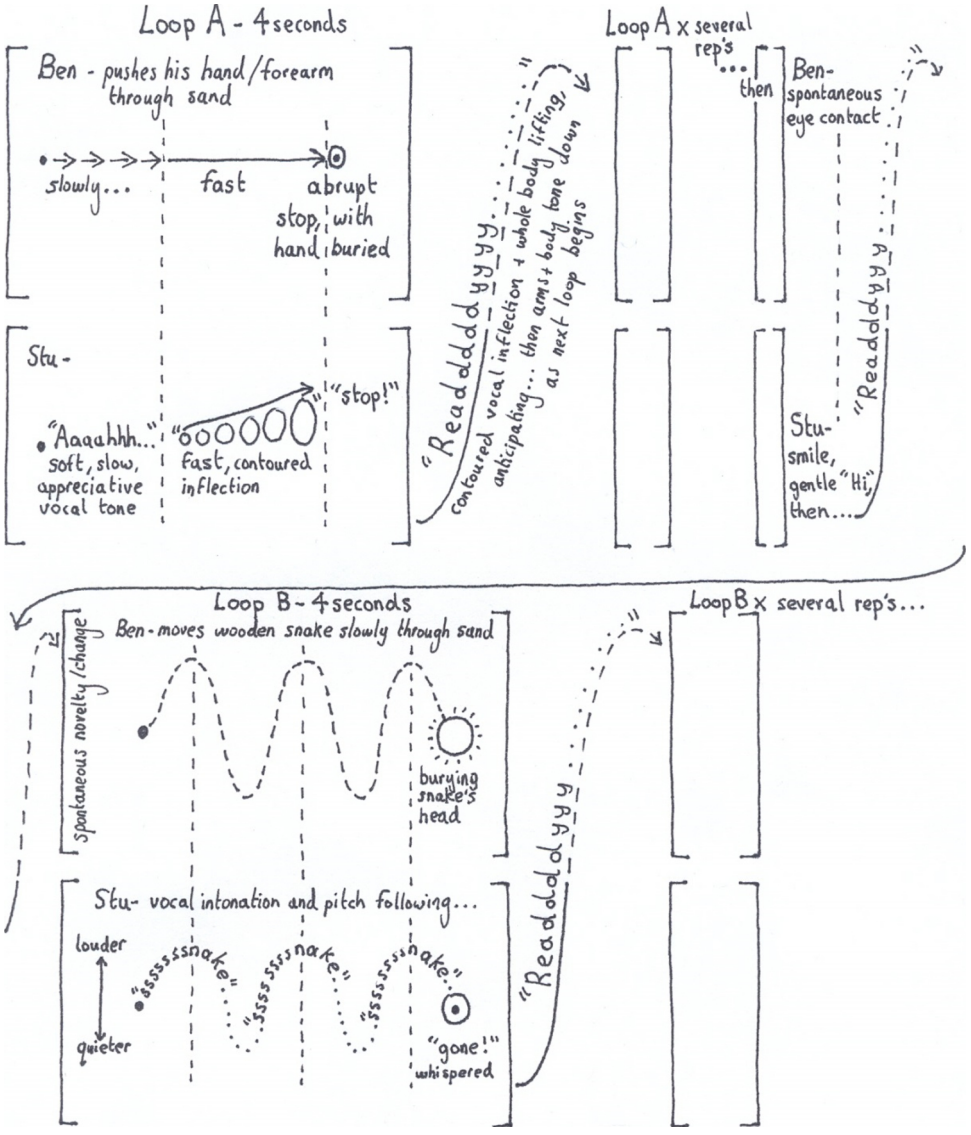

Diagram 1.

and shoving of trains, whispered a rhythm alongside the hyper-visual experience of dropping water through sunlight, played a pulse beat via gentle thumb squeezes, made up a song to stacking blocks. Diagram 2 describes the early stages of a shared rhythm. The experience develops in terms of inter-synchrony and spontaneity later on (in Diagram 5). Here in Diagram 2, Ben initiates play with two toy elephants and I vitality-match and develop the walking dynamics with the energy flow of my rhythm.

Goal. To introduce prosocial, feed-forward, anticipatory potential into the pulse and vitality of the loop:

- become integral to the loop… a social component in the circular rhythm, needed for a sense of self-completion in both pulse and vitality – through vitality- matching, attuned and relevant variation (being the right level of interesting!), playing with initial and added rhythm
- introduce jazz gaps
- encourage prosocial signifiers from the child - eye contact, physical gesture, vocalizations, words

Ben is pushing a toy car forwards then backwards. At some point he includes a quiet car sound-effect. This is Ben's loop: [*sound-effect starts, car forward, sound- effect stops as the car backs up, micro pause*], then again, [*sound-effect starts*…etc.]. This loop might evolve naturally for Ben. More likely however, it will fade out without progressive movement after many identical iterations. After a few loops, I decide to introduce something new… On queue with the car backing up, in the rhythmic pause after Ben's sound effect stops, I introduce a comedy car-'screeeeech' (braking hard) and a loud bass-tone sound effect for the car reversing. Ben smiles. We play through a few loops like this. It was a little gamble, but now I am becoming integral to the completion of the loop. Now I can try a *jazz gap*…

A tool for developing the anticipatory quality of play is the *jazz gap*. Here, a jazz gap refers to a pregnant pause deliberately interjected into the rhythmic flow of communication. I use the term in reference to the held-beat of syncopation – a definer of jazz riff quality. A jazz gap holds a silence just longer than the natural on-beat demands. It plays with the natural human capacity for musical time-keeping – a beat is expected, the attention is tied with anticipation over the pulse where that beat should be. A jazz gap has the energy of needing to be filled.

In Diagram 3, Loop B, Ben has come to expect my sound-effect. It

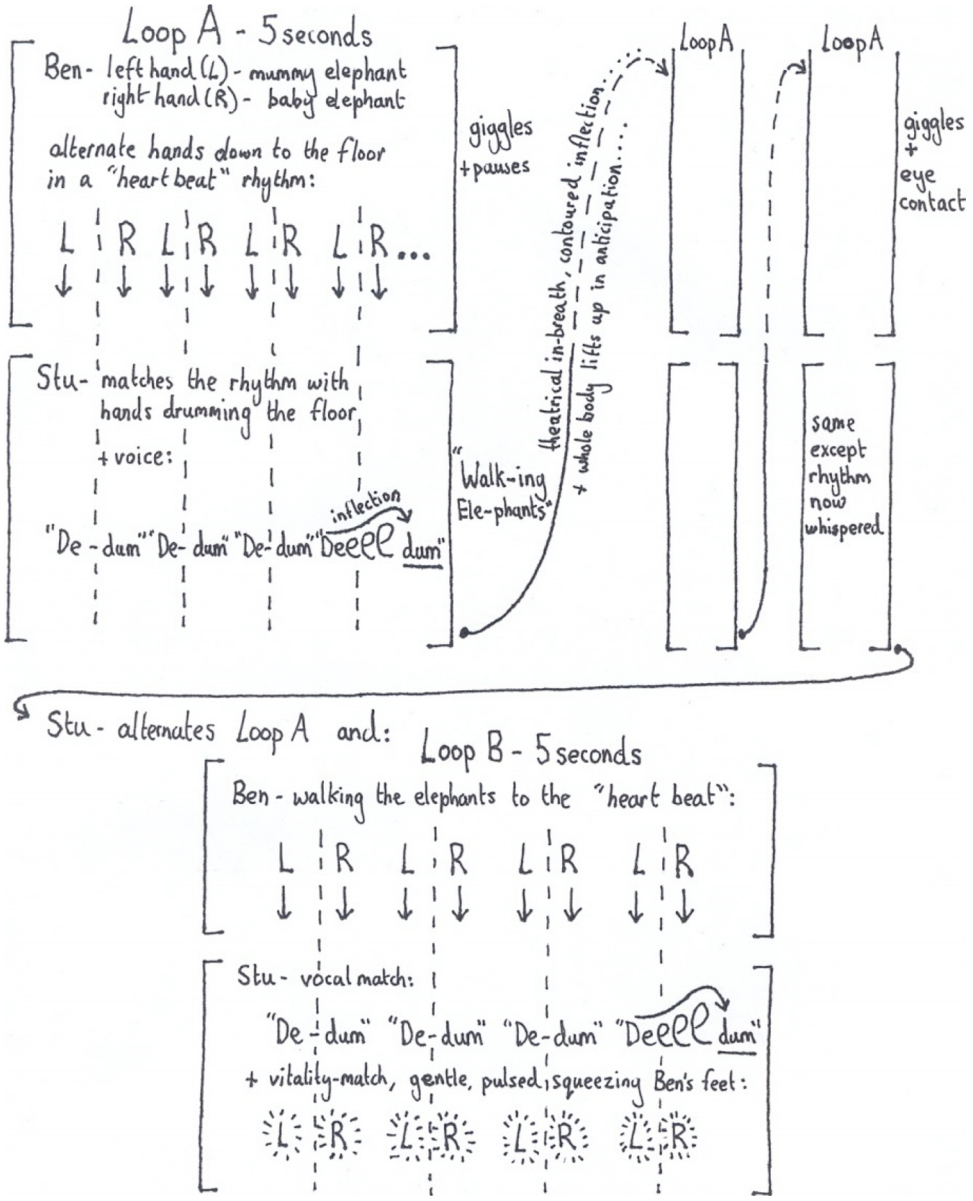

Diagram 2.

has become an integral part of the rhythm of the loop. This time I pause before starting and I wait until Ben, in anticipation, makes eye contact. Immediately I begin the sound-effect, Ben smiles and giggles and the loop continues. The previously internal loop, closed and asocial for Ben, has become interactive. He has rhythmic support for anticipating my interactive movements and, within that rhythm, is experiencing happiness in response to his motivated, spontaneous use of prosocial signifiers (here, eye-contact).

We can play with the held duration of a jazz gap over a range corresponding to the short cycles of somato-motor co-ordination – around 1.5-5 seconds - described above (from Trevarthen & Delafield-Butt, 2013) as constituting the "psychological present". If we push the duration much past this range, we loose the rhythmical impetus of the "here and now". "The current consensus in music psychology and cognitive neuroscience is that the ability to associate beats, or perform them meaningfully as a pulse, stops at around six seconds or 0.16Hz… It is at this point that the mind and body can no longer "lock on" - either actively through playing, or passively through listening - to the rhythm as a pulse" (Osborne, 2017, pp 18-19).

Goal. To develop the prosocial, anticipatory potential of the flow of vitality in the loop (helping evolve loops into short, contoured social narratives defining the "extended present"):

As the concept of 'closed loops' becomes blurred with the introduction and facilitation of inter-synchrony, these loops have the potential to evolve into more sophisticated narratives of play, extended in time, form, and sociability. We can encourage loops to stretch into the classical contoured structure of healthy infant-parent play – Introduction (Initiation and Orientation), Development (Anticipation, Acceleration and the Heightening of Excitement), Climax (Peak of Excitement), and Resolution (Deceleration and Re-orientation) (Brazelton, Koslowski & Main, 1974; Stern, 1999, [Stern, 2010] 2010; Malloch & Trevarthen, 2009).

Ben, sitting in the sand tray, is pouring sand on his bare feet. He is repeating the phrase, "rain cloud, lightning storm… rain cloud, lightning storm". I share with him, vitality-matching his pleasurable, textured experience with vocalizations - "shhhhhhhh… aaaahhhhhh" - and whole-body sighs and wiggles. Next, I scoop some sand and help him cover his feet. Enjoying my involvement, Ben is open to me introducing

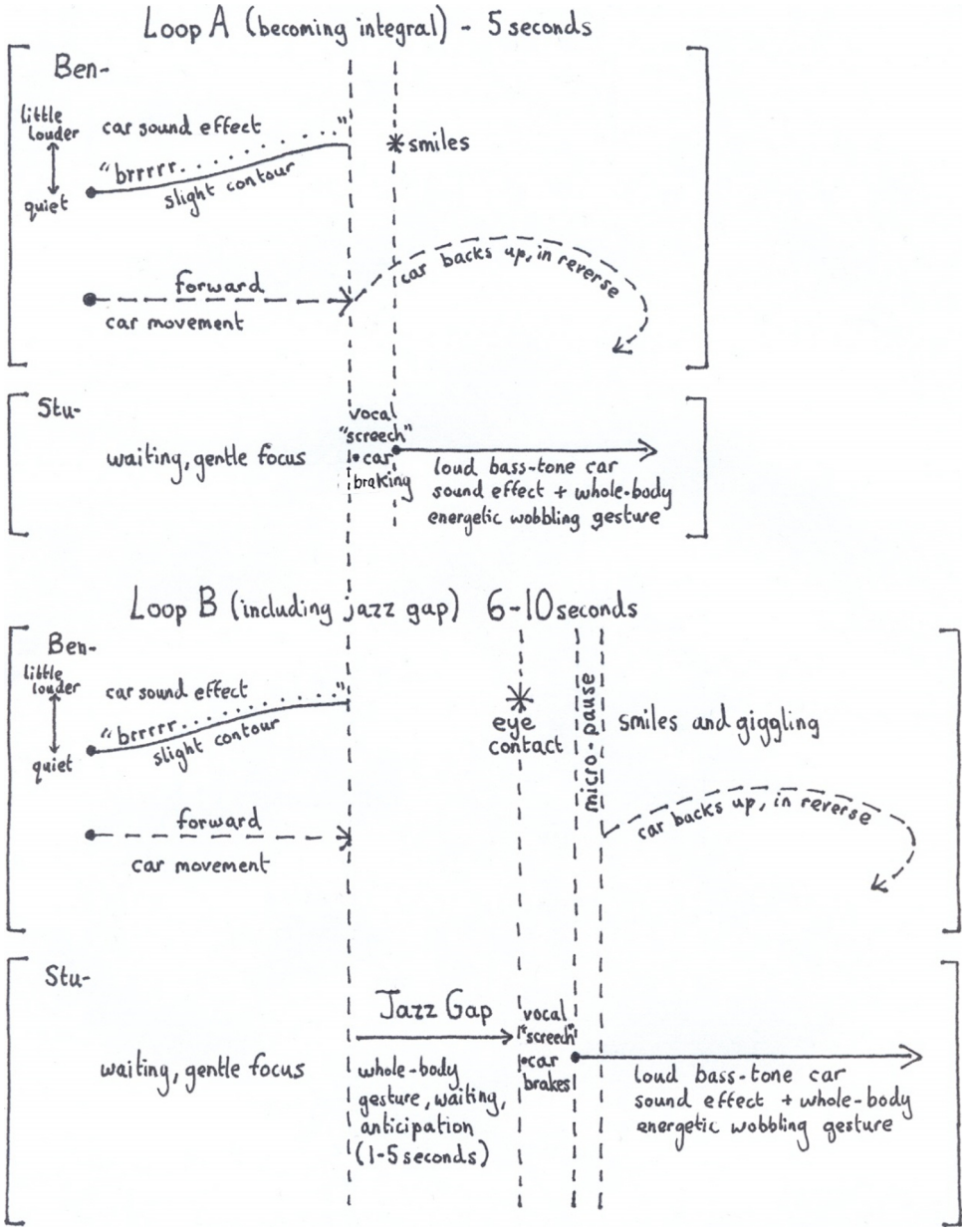

Diagram 3.

a jazz gap – I wait for eye-contact as a signifier – before I pour the sand. It is going well and Ben is giggling between his rhythmic phrases. Diagram 4 shows how I stretch and develop this shared loop into a shared contoured narrative.

After a few iterations, the momentum of this play led Ben into a spontaneous creative act – pretending the sand was rain water to drink – and then to independently reach out to me to develop the game, "Stu, drink some!", offering me sand from his hand.

Goal. To facilitate opportunities for the experience of choice and personal agency within loops and contours

Each child with autism has, to differing degrees, a disrupted sense of social-self and a limited sense of agency (Hobson, 1993; Maestro et al., 2005; Trevarthen, 2000). In play therapy we can use rhythmically supported anticipation, the jazz gap, and prosocial signifiers to facilitate experiences of agency, choice and control.

Playing with a train, Ben navigates the perimeter of a toy castle. He can't quite manage to pass the train around the back of the castle, his arms don't quite reach. Following the flow of the Ben-Train's movement with my body, I tentatively reach to take hold of and continue the motion of the train - completing the circle around the castle. This is the first time I have felt to physically connect with Ben's object-play. It's okay and Ben communicates his approval with a small smile. We play through this loop several times before I introduce a jazz gap, waiting for Ben's eye contact before I complete the train's movement…

Here, Ben has the choice to instigate the next phase of movement or not – through eye-contact as signifier. His playful sense of self as a social agent is building. As Self-Other-Object play develops in subtlety, so does a child's sense of confident, social, empowered self (Hubley & Trevarthen, 1979). I want to facilitate this deepening subtlety for Ben and so add a new element to the loop.

… In a previous session Ben had played meaningfully with a toy bridge, so I knew he connected with 'bridge' as concept. Moving with the flow of the Ben-Train, and just at the point of jazz gap, I bend down on all-fours making a human bridge across the natural path of the train. Ben is a little confused but, as he makes eye contact, I take the train under the bridge and complete the loop – passing the train back to Ben

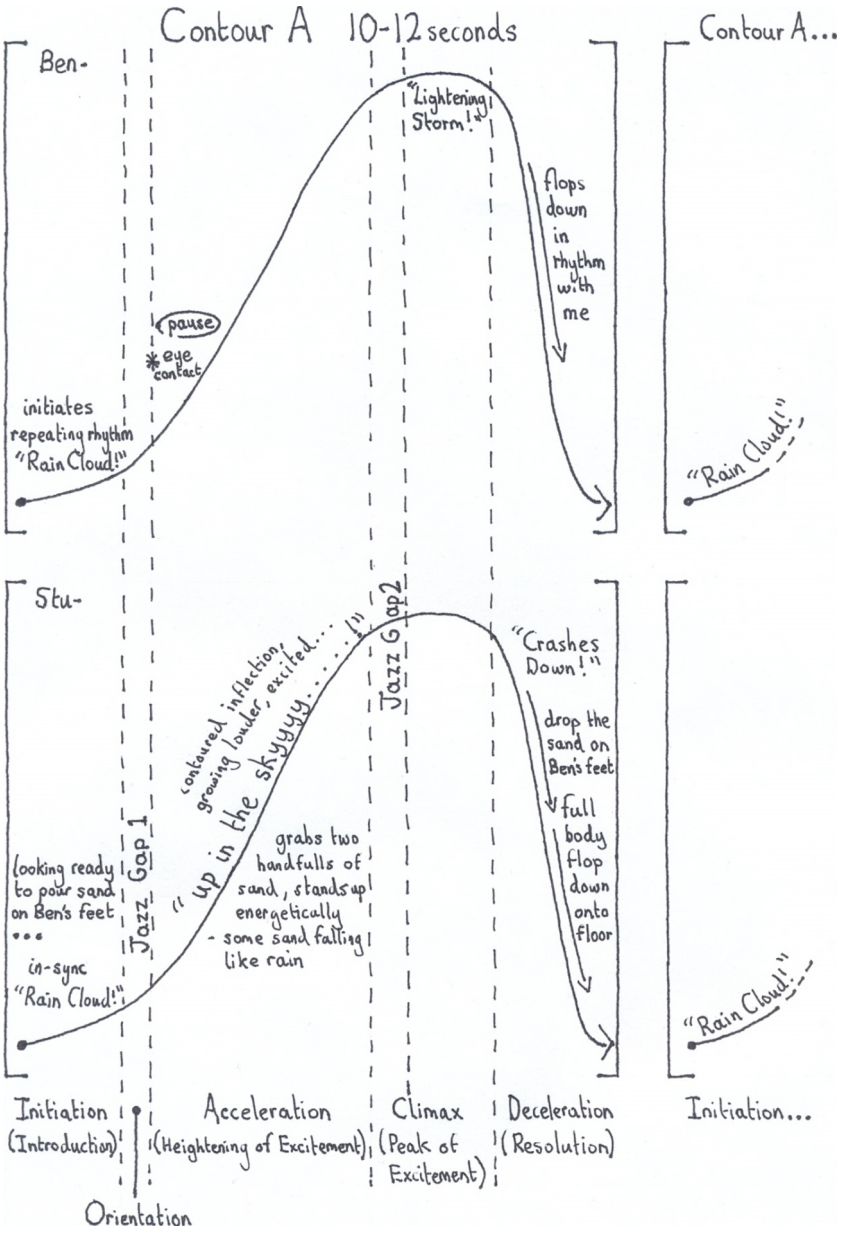

Diagram 4.

on the other side of the castle. Ben laughs and jumps up and down! Over the next few iterations of the loop I introduce the possibility of the train going over the bridge or under the bridge. Ben takes control of this choice, using the words “over” and “under” as signifiers. Sometimes he uses this agency to instruct me, and sometimes he takes the train and rolls it over or under me himself – another level of choice.

Goal. To facilitate opportunities for language learning within loops and contours

I have worked in several special education schools and with various language-support programmes for children with ASD. Most of these programmes focus on piggy-backing on the power of a strong motivator such as a favoured object or desired food. Sadly though, the impact of such programmes often looses momentum as they fail to connect with, or generate, prosocial motives. Language needs the musicality of play. Words are 'hung' on the rhythmic structures of shared narratives and need the anticipatory impetus of pulse and vitality to bring prosocial and emotionally sophisticated meaning. We can use jazz gaps and prosocial signifiers, within rhythmically supported loops and contours, to give space and energy for words to gain meaning.

Ben loves the sensation of pouring glass beads through his hands. Through vitality-matching – using emotional vocal tone, inflection and whole-body gestures – I share his enjoyment in this looping experience. As the flow of beads trickle to a stop, there is a natural pause in the play. At this point, after a few iterations of the loop, I pick up some beads myself and (with an anticipatory, rising- inflection vocal “oooooo”) I begin to pour them slowly over Ben's *feet*. He laughs. We play out this new loop several times. I am now integral to the completion of the rhythm. I introduce a jazz gap, initially waiting for eye-contact before pouring the beads. Over time, I introduce a row of little boxes to catch the beads as they trickle off Ben's feet. The boxes are coloured and, with the jazz gap impetus, Ben learns to use a colour-signifier-word to choose which box we will aim into. I then replace the coloured boxes with plain ones - one each with a photograph of Ben's mother, father, and sister. With the rhythmic support of the jazz gap, Ben is motivated to choose a box through proto- declarative pointing. As he points, in each instance I state “mummy”, “daddy” or “Claire”. I

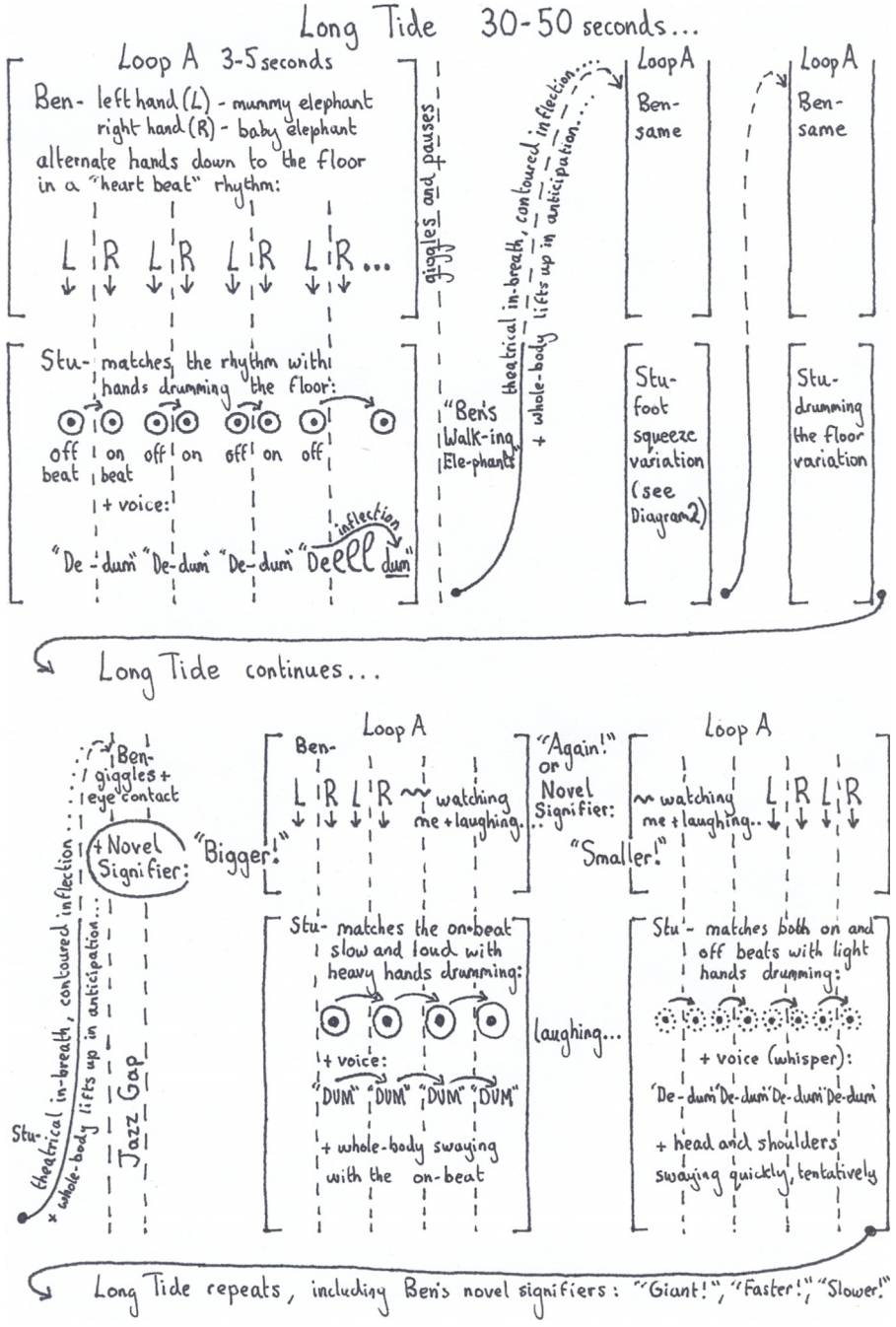

Diagram 5.

then recruit the real family members to be part of the game. Within only a few iterations Ben has learnt the names of his family for the very first time. And as we have piggy-backed on the creative impetus latent within Ben's initial loop, there is inherent energy in this learning beyond simple behaviourist stimulus-response. This self-generating creativity, now integrated and active in Ben's experience, enables him to generalise this learning (something often difficult for children with ASD). Ben is now able to use the names of his parents and sister in any context.

Goal. To deepen the social impact of a series of short loops or narratives by giving them a longer, regular tide of rhythm in which to develop

- facilitate inter-synchrony over a longer tide of time
- facilitate time to integrate, process and respond within a steady pulse and/or a steady patterned flow of vitality

When interacting with a child with ASD, most adults significantly underestimate the time the child might require to process and respond after, for example, a question is posed, suggestion made, direction given, schedule altered. We need to give a lot of space for response. We can also facilitate this space within rhythm. We can extend successive iterations of a mostly-repetitive loop into a longer tide of rhythm – using identical rhythmic links between each loop. Here, each loop becomes as if a short phrase in the longer rhythm of a song. The child is "held" safely within the rhythmic structure, compelled by its impetus and given many looping iterations in which to creatively respond.

Diagram 2 gave an example of when I matched, and developed, a rhythm initiated by Ben. We walked a pair of elephants in a "heart beat"

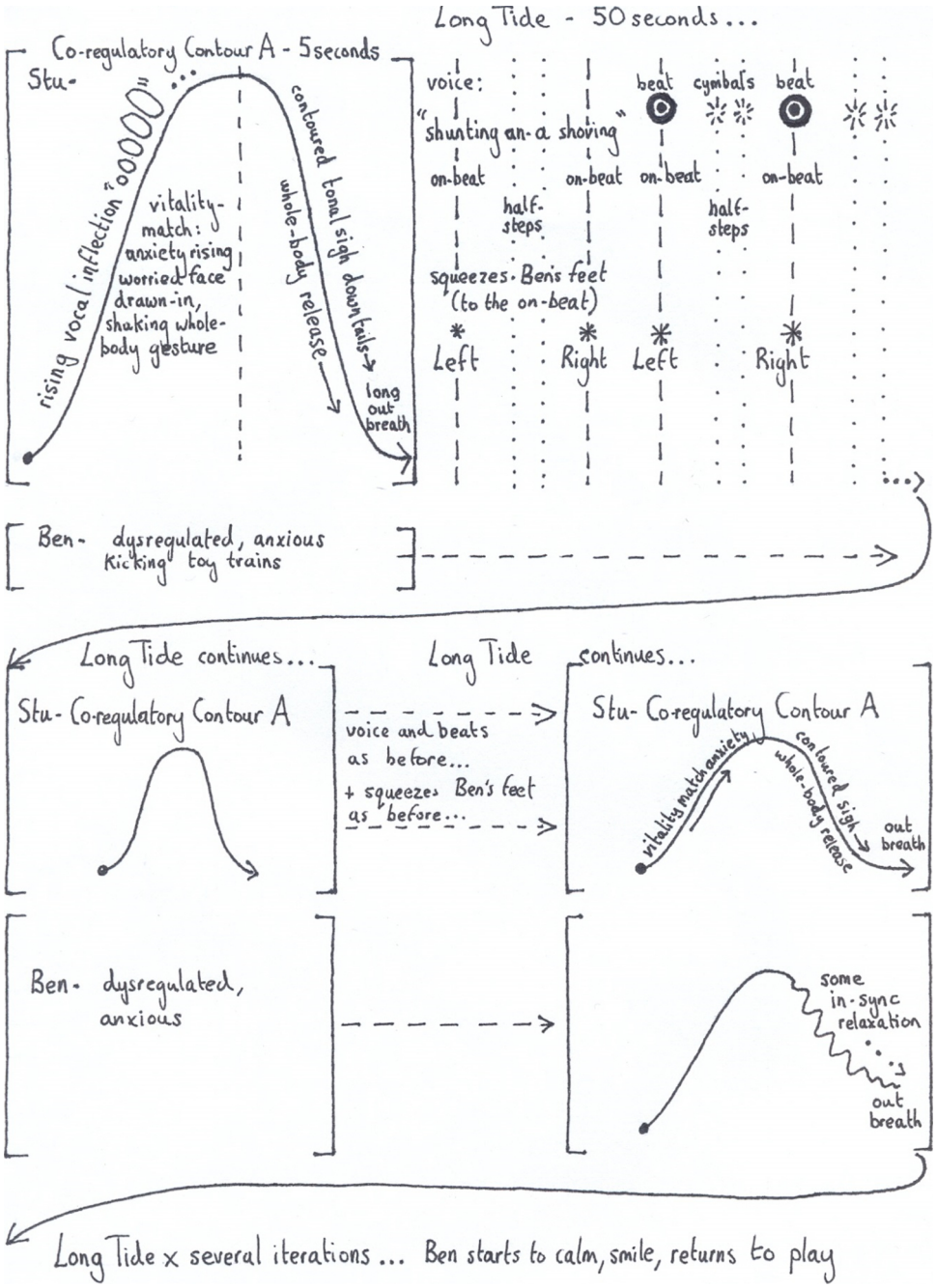

Diagram 6.

iambic pentameter. In Diagram 5, I develop these short rhythmic loops into an extended series. The longer tide gives Ben the time to engage deeply – he laughs a lot, initiates new elements, creates his own novel signifiers to direct me in the play, and then generalises the rhythmic structure, using it in new contexts and returning to it spontaneously at later dates.

Goal. Using a long tide of rhythm to support co-regulation of anger/anxiety down to a calm state

- facilitate co-regulatory micro-contours epitomized by a down-tailed inflection towards calm state
- support these co-regulatory micro-contours within longer tides of calming rhythmical interaction

Children learn to self-regulate via shared experiences with others – through co-regulation. It is in playful interaction that children experience their vulnerability and gradually learn to dampen their own neurophysiological defense patterns - which in turn allows for the flourishing of the parasympathetic rhythms of social engagement (Porges, 2015; Porges & Furman, 2011; Porges, 2007; Porges, Doussard-Roosevelt, Portales, & Greenspan, 1996). We can support children with ASD to access co-regulatory experiences. The parameters of communicative musicality can help us develop effective co-regulatory micro-contours *and* appreciate the calming effects of contextualising them within long tides of extended interactive rhythm. Co-regulatory micro-contours (1.5 – 5 seconds) will usually involve the shared experience of travelling through a vulnerability contour together (vitality matching) with the therapist then pulling the tail- end of the contour into a calming, down-tailed inflection (for example: a shared whole-body sigh

and shake with a downwards vocal inflection towards a long out-breath). Diagram 6 describes several iterations of a co-regulatory micro-contour within a long tide of rhythm (30-50 seconds). As with a mother's lullaby, the long-tide (the song) is "holding" the micro-contours (each one a line) and so, regulating the child's sense of continuous flow between moments of "psychological present".

Diagram 6 is an example of co-regulation of anxiety. Ben has been pushing lines of trains back and forth and repeating the phrase "shunting and shoving, shunting and shoving…" In a previous play therapy session I had played with a simple beat-box accompaniment, with a regular "chorus" line sharing Ben's words but altered in rhythm, "shunting an-a shoving, shunting an-a shoving…" In Diagram 6 Ben starts off anxious, highly dysregulated, because two particular train engines do not connect properly. I bring in my beat-box/chorus rhythm as a long-tide to include many iterations of a co-regulatory micro-contour. As with Diagram 2 and 5, I introduce rhythmical, calming touch within the long-tide pattern – helping Ben ground his body's experience through contact.

Goal. To support self-synchrony for inter-synchrony

- facilitate layers of integration of multi-modal sensory information

Both vitality matching and playful physical contact can, within tides of rhythmically supported interaction, help a child with ASD experience his body in new ways. Temporally regulated neural connections between different sensory modalities can be facilitated. In many of the diagrams above, I support the spontaneous use of eye contact, proto-declarative pointing, gaze- tracking and eye-pointing as social signifiers. The use of rhythm as compelling structure, the jazz gap as temporal catalyst, the calming and engaging effect of inter-synchrony, and the vitality-matching of Ben's emotive and motoric patterns all serve to facilitate the timed control of the muscular groups necessary for such prosocial gestures – i.e. the muscles controlling the face, head, neck, hands, jaw, and eyes. In all of the above diagrams/examples, I accompany Ben's sensori- motor experiences with vitality-matching through sound effects, rhythm, vocal inflections, and whole- body gestures. Inherent in this manner of communication is a deepening integration of Ben's experience of his own moving body. In Diagram 2, 5, and 6 I use physical touch in rhythm, and in Diagram 4 and the glass-bead example I use well-timed tactile experiences, all to support this rhythmical embodiment further.

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